Gemini
Ultra™
TOTAL SYSTEMS

User's Guide

TOTAL SYSTEMS

Sales

1-800-874-2288, or 503-345-7395, from 8:30 to 5 p.m. weekdays, PST.

Technical Support Group

503-345-1098, from 9:00 a.m. to 4:00 p.m. weekdays, PST.

Bulletin Board System 503-344-8709. Log in as GUEST, password GUEST

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Thank you for purchasing a Gemini Ultra card. TOTAL SYSTEMS is committed to providing you with complete support for your existing product, while also making available future enhancements which will protect your investment into the future. Be sure to return your Warranty Registration Card so that we can keep you informed of new developments.

Warranty

a. Scope of Limited Warranty. TOTAL SYSTEMS ("Seller") warrants to the original consumer purchaser that Seller products will be free of defects in materials and workmanship, under normal use, for the periods described below. The warranty begins on the original retail delivery date, or on the date of first use, whichever occurs earlier. The Gemini Ultra card is covered for one (1) year after delivery or first use, whichever is earlier. This warranty shall be effective only if and when (1) Seller receives a completed warranty registration card with respect to the specific product unit found to be defective; and (2) Seller receives notice of such defect during the period of the warranty. Seller's sole and exclusive liability for breach of warranty shall be (at Seller's option) to repair or replace the defective Seller products or return the purchase price for any defective products that are returned during the warranty period. Seller products repaired or replaced under this warranty are subsequently warranted for 90 days or the duration of the original warranty, whichever is longer. If Seller elects to repair or replace the product, Seller shall have a reasonable time to do so.

b. Limitations of Implied Warranties. TO THE EXTENT ALLOWED BY LAW, ANY IMPLIED WARRANTIES, INCLUDING ANY IMPLIED WARRANTY OF MERCHANT-ABILITY OR FITNESS FOR A PARTICULAR PURPOSE APPLICABLE TO SELLER PROD-UCTS ARE LIMITED IN DURATION TO THE DURATION OF THESE WRITTEN WAR-RANTIES. Some states do not allow limitations on how long an implied warranty lasts, so the above limitation may not apply to you.

c. Exclusion of Remedies and Liability. IN NO EVENT SHALL SELLER, ANY DISTRIBU-TOR, OR THE SELLING DEALER BE LIABLE FOR ANY DIRECT, INDIRECT, SPECIAL, INCIDENTAL OR CONSEQUENTIAL DAMAGES (INCLUDING LOSS OF PROFITS, LOSS OF TIME, OR INCONVENIENCE) WHETHER BASED ON CONTRACT, TORT, STRICT LIABILITY OR ANY OTHER LEGAL THEORY EVEN IF SELLER, SUCH DISTRIBUTOR, OR THE SELLING DEALER WAS ADVISED OF THE POSSIBILITY OF SUCH DAMAGES. Some states do not allow limitation of incidental or consequential damages, so the above limitation may not apply to you.

d. Limitation of Warranty. The foregoing warranty shall not apply to defects resulting from (i) improper or inadequate maintenance; (ii) unauthorized modification of the products; (iii) operation of the products outside of their environment specifications; (iv) improper installation; (v) neglect, misuse or abuse of the products; (vi) return of product without being

shipped inside original conductive, shielded packaging; or (vii) integration with other products not covered by a seller warranty. This warranty shall not apply to any products not manufactured by Seller. No one is authorized to change or add to this warranty.

e.   **Technical Assistance.** The warranty set forth above shall not be enlarged, diminished or affected by, and no obligation or liability shall arise from Seller, any authorized dealer or any other person rendering of technical advice, assistance or service in connection with the selection, purchase or use of any Seller products.

f.   **Installation.** Seller makes no warranty with respect to any installation of Seller products by Seller, any authorized dealer or any other person.

g.   **Other Rights.** This warranty gives you specific legal rights. You may also have other rights which vary from state to state.

h.   **Place of Repair or Replacement.** In order to obtain the benefits of this warranty, the defective Seller products must be returned to Seller at its plant at 1720 Willow Creek Circle, Eugene, OR 97402-9152, or to an authorized dealer, with transportation charges prepaid. Seller shall pay for the return of the repaired or replaced Seller products to you by surface transportation.

Specifications

System Requirements:	Macintosh SE
	Macintosh Plus
	Macintosh 512K enhanced
	Macintosh 512K (w/128K ROMs)
CPU	Motorola MC68030
	Access to 68000 using the programmer's switch
FPU	Motorola MC68882
Clock Speed	20MHz, 33MHz or 50MHz
	Ability to startup between 10MHz and 25MHz using fractional speeds; ability to run at 1.0 or 0.5 times clock speed to accommodate older, slower hard drives
Data Path	32-bit data bus using standard SIMMs at 1, 3 or 5 wait states
	Burst-mode access supported
Memory	4, 16 or 64MB of 32-bit RAM using standard 1MB, 4MB or 16MB SIMMs. See Wait State table (**Chapter 2**) for RAM speeds required at various clock speeds
SIMM compatibility	SOJ (surface mount SIMMs) only
SCSI Interface	Macintosh SE: uses standard SCSI connector
	Macintosh 512K/Plus: uses built-in Gemini Ultra high-speed SCSI interface with a throughput of up to 1.2MB/second
Expansion Connector	64-pin connector for Galileo large screen display card or Ethernet card
Power Consumption	3.75W at 25MHZ, 6.25W at 50MHz
	Macintosh 512K/Plus: uses GemPower auxiliary power supply module included
Cooling	Macintosh SE uses own internal fan
	Macintosh 128K/512K/Plus: uses included 110v GemFan internal fan

Diagnostics	Full on-board diagnostic test on power-up
Support Software	GemStart:
	Instruction Cache
	Data Cache
	AppleTalk Driver
	Sound Manager
	Use FPU for SANE
	Copy ROM code into 32-bit RAM
	"Fool Applications" feature (GemStart 2.4)
	VIRTUAL (included):
	Virtual memory to 16MB (VIRTUAL 3.0; 4MB of RAM)
	Access to 16MB of physical RAM (VIRTUAL3.0; 16MB of RAM)
	Access to main logic board RAM disk
	Move I/O addresses option
Software Compatibility	Gemini Ultra is compatible with all current versions of major software that:
	A. Comply with current Apple Computer, Inc., programming guidelines for Macintosh
	B. Do not require ROMs above the level of the host Macintosh. Compatible with Apple Systems 6.0.7, 6.0.8 and System 7.0.
Upgrades	Field upgradable from:
	68882 FPU
	20MHz to 50MHz
	Macintosh 512K/Plus to Macintosh SE
Warranty	12-month limited warranty, parts and labor

For Experienced Technicians Only...

Here are quick instructions to help you install a Gemini Ultra accelerator card. Video (external display) installation is *not* covered here—see the *rest* of the manual!

Warning!

Prior *to installing the Gemini Ultra into your Macintosh, take the time to make a back-up copy of the contents of your hard drive.*

Preparing the Gemini Ultra card

☐ 1.   Ensure that the 68030 CPU and 68882 math coprocessor (optional) have been installed.

☐ 2.   Fill all four SIMM sockets with 1MB or 4MB SIMMs.

☐ 3.   Refer to the Wait State Settings chart in **Chapter 2** to determine the correct settings for DIP switches 5 and 6 on the Gemini Ultra card.

☐ 4.   Refer to the Fractional Speed Settings chart in **Chapter 2** to determine the correct settings for DIP switches 3 and 4 on the Gemini Ultra card.

Installing Gemini Ultra into the Macintosh SE

Using standard Apple procedures, remove the main logic board from the Macintosh:

☐ 1.   Make sure the Macintosh main logic board is configured with at least 512K of RAM. Refer to the chart of resistor settings if you have changed the amount of memory on the main logic board.

Configuration	512K	1MB	2MB	2.5MB	4MB
resistor version R35 (150Ω)	join	join	cut	cut	cut
resistor version R36 (150Ω)	join	cut	join	cut	cut
SE jumper version	not connected	1MB position	2/4MB position	not connected	not connected

☐ 2. Make sure that the Gemini Ultra card connector mounts flush with the main logic board expansion slot.

☐ 3. Use the one-piece plastic stand-off to support the opposite end of the accelerator card above the main logic board.

☐ 4. Reconnect the speaker, internal floppy drive, main power, and internal hard drive cables to the main logic board.

☐ 5. Remove two central floppy drive screws from underside of chassis to prevent Gemini Ultra's SIMMs from shorting.

☐ 6. Reseat the main logic board in the chassis.

☐ 7. Remount and secure the rear half of the case with the mounting screws.

☐ 8. Replace the programmer's switch.

☐ 9. Install GemStart onto the System drive.

☐ 10. Test functionality.

Installing Gemini Ultra into the Macintosh Plus

Using standard Apple procedures, remove the main logic board from the Macintosh:

☛ To mount your Gemini Ultra card onto the main logic board with the Killy clip:

☐ 1. Clean the connectors of the CPU with isopropyl alcohol and a toothbrush.

☐ 2. Seat the Killy clip onto the CPU. Ensure the clip is fully seated and **flush** with the main logic board.

☐ 3. Mount the 64-pin spacer socket on top of the Killy clip.

☐ 4. When the socket is fully seated, make sure that none of its pins are bent.

☛ To mount your Gemini Ultra card onto the main logic board using the soldered pin modification method:

☐ 1. Clean the connectors of the CPU with isopropyl alcohol and a toothbrush.

☐ 2. Using the 64-pin spacer socket as an alignment jig, mount a 32-pin header strip into each side of the socket.

☐ 3. Now mount the header pin/socket combination over the CPU. Note that the header pins are about 1/16" to 1/32" above the main logic board, and that the header pins, **not** the 64-pin socket, mount onto the CPU's legs.

☐ 4. Finally, solder each header pin carefully to the corresponding leg of the CPU. Fix the four corner pins first. Take great care not to overheat the work.

Proceeding with the Installation

☐ 1. Make sure the Macintosh main logic board is configured with at least 512K of RAM. Refer to the chart of resistor settings if you have changed the amount of memory on the main logic board.

Configuration	512K	1MB	2MB	2.5MB	4MB
R8 (150 Ω)	join	join	cut	cut	cut
R9 (150Ω)	join	cut	join	cut	cut

☐ 2. Mount the Gemini Ultra card onto the main logic board.

☐ 3. To install the GemFan/GemPower bracket, locate the four screws that attach the internal disk drive housing to the Macintosh chassis. Remove the two rear screws. Note the two empty holes near the front screws.

☐ 4. Mount and secure the fan bracket through the two unused chassis holes near the front of the disk drive cover and the two holes at the rear where you removed the screws. Route the disk drive ribbon cable through to the bottom of Macintosh where the logic board usually sits, then position the bracket so that its bolts protrude through the four holes. The four bolts that connect the fan bracket to the inside of the Macintosh are not uniform — the top right bolt must be shorter than the others to clear the Gemini Ultra card.

☐ 5. Connect the auxiliary power connectors to the CR23, CR24, CR25, and CR26 diodes on the analog board.

☐ 6. Install the Galileo video card and adapter card, if you have purchased them. Refer to the Galileo instructions.

☐ 7. Route the SCSI cable down through the opening in the chassis to the Gemini Ultra card. Attach the lower end of the SCSI connector to the SCSI slot at the front of the accelerator card. The slot is keyed, so that it is difficult to connect the cable incorrectly.

Warning!

Use only a SCSI cable supplied with a Gemini Ultra card — do not use a cable from an earlier Gemini accelerator.

☐ 8. Tape chassis bevel with insulation tape to prevent Ultra's SIMMs from shorting. Connect the auxiliary power cable to P3 on the Gemini Ultra card. Connect the internal floppy drive, hard drive, and main power cables to the main logic board.

☐ 9. Seat the main logic board inside the chassis.

☐ 10. Cut off the raised edge of the battery holder to accommodate the width of the ribbon cable.

☐ 11. Route the SCSI cable through the battery door opening while positioning the rear case half. The new connector replaces the battery door.

☐ 12. Secure the rear half of the case with the mounting screws.

☐ 13. Replace the programmer's switch.

☐ 14. Test functionality.

NOTE   **Don't forget to send in your Warranty Registration card!**

Warning!!!

Warning!

Installing the accelerator card, adapter card and video card components of your external display requires basic mechanical skills. Also note that the Macintosh contains components that may retain a high-voltage charge for some time after the computer has been turned off. Touching one of these parts incautiously can cause personal injury or damage to your Macintosh.

FREE INSTALLATION is offered on all TOTAL SYSTEMS products. (Shipping charges are not included in this offer.) If you are uncertain about your ability to install the accelerator card, adapter card or video card yourself, please take advantage of this FREE INSTALLATION OFFER. Contact TOTAL SYSTEMS at 1-800-874-2288 for information.

If you have already tried the installation yourself and failed, the installation is NOT free. IMPROPER INSTALLATION WILL VOID THE WARRANTY ON THIS PRODUCT.

Warning!

You MUST use a TOTAL SYSTEMS model V3000 adapter card with the Gemini Ultra accelerator card.

Earlier models of TOTAL SYSTEMS adapter card (model V2200 or earlier) <u>WILL SEVERELY DAMAGE</u> your Gemini Ultra card, your video card, and/or your Macintosh!

Model V2200 adapter cards are labeled "TOTAL SYSTEMS Video Expansion Kit". Model V3000 adapter cards are labeled "TOTAL SYSTEMS GEMINI ULTRA VIDEO EXPANSION KIT" just below the P2 connector. A chip labeled "V3000" is inserted in the socket at U1. There are <u>TWO</u>, rather than <u>ONE</u>, rust-colored 90° connectors at the left end of the adapter card. See Figure 1-1 to help you identify your adapter card.

Make sure you have the correct adapter card before proceeding with installation. IF YOU DON'T, CALL TOTAL SYSTEMS FOR ASSISTANCE. USING THE WRONG ADAPTER CARD WILL VOID YOUR WARRANTY.

Table of Contents

Introduction

Congratulations!

Congratulations on your purchase of the Gemini Ultra™ card for your Macintosh® computer! Now you can take your productivity to new heights!

What the Gemini Ultra can do for you

Your Macintosh personal computer is a powerful productivity tool. Macintosh applications are continually being improved, extending the range of their capabilities, while retaining the ease-of-learning and ease-of-use which has made the Macintosh famous.

To keep pace with these advances in software technology, you will have to upgrade the hardware capabilities of your Macintosh. The Gemini Ultra helps you stay at the cutting edge with:

- **Sheer processing power.** The high-speed 68030 processor is dramatically more powerful than the original 68000 processor.

- **Fast RAM capacity.** The Gemini Ultra supports up to 16MB of high-speed RAM, greatly extending the RAM capacity of the Macintosh, and allowing faster RAM to be used. The fast RAM allows the 68030 processor to run at full speed, maximizing its power.

- **High-speed SCSI Interface.** The availability of large-capacity hard drives, slide makers, and high-quality image scanners with standard SCSI interfaces puts a premium on fast throughput of data. The Gemini Ultra gives a SCSI interface to the Macintosh 512K for the first time, and runs faster than the standard SCSI port on the Macintosh Plus.

- **Large-screen video interface.** Large screen monitors make a great difference when working with desktop-publishing applications and spreadsheets by allowing you to see more of your data at the same time. This boosts productivity, by reducing scrolling time and may improve the quality of your work by allowing you to see it as it will appear when printed.

- **Sophisticated utility software.** The software allows you to quickly configure your accelerator for maximum performance. With GemStart, you can toggle the instruction and data caches of your processor for software compatibility, force floating-point calculations to go to the optional floating-point math coprocessor, and copy your Macintosh ROM into high-speed RAM for even faster performance.

Unsurpassed performance, unparalleled flexibility

- The Gemini Ultra is a state-of-the-art accelerator, providing unsurpassed performance for your Macintosh SE or Macintosh Plus computer. With the 20, 33 or 50MHz 68030 processor and 68882 FPU, and using fast RAM, the Gemini Ultra can exceed the performance of Apple Computer's Macintosh IIci computer — even approaching Macintosh IIfx performance — for a fraction of the cost! And you can start at 20MHz today, and upgrade your speed step-by-step as you prefer — all the way to 50MHz.

- Gemini Ultra supports both 1MB and 4MB SIMMs, allowing you to install either 4MB of RAM, or 16MB of RAM on the card. Using 4MB SIMMs requires VIRTUAL™ from Connectix Corp. With less expensive 1MB SIMMs installed, you can also use VIRTUAL, letting you exploit spare hard disk space as if it were RAM.

- When VIRTUAL is installed, Gemini Ultra allows you to use RAM on the main logic board of your Macintosh as a RAM disk. And you can allocate additional RAM from your accelerator card to the RAM disk, too, for maximum flexibility!

Warning!!

Warning!

Installing the accelerator card, adapter card and video card components of your external display requires basic mechanical skills. Also note that the Macintosh contains components that may retain a high-voltage charge for some time after the computer has been turned off. Touching one of these parts incautiously can cause personal injury or damage to your Macintosh.

FREE INSTALLATION is offered on all TOTAL SYSTEMS products. (Shipping charges are not included in this offer.)

If you are uncertain about your ability to install the accelerator card, adapter card or video card yourself, please take advantage of this FREE INSTALLATION OFFER. Contact TOTAL SYSTEMS at 1-800-874-2288 for an authorized TOTAL SYSTEMS dealer in your area, or for a factory installation.

If you have already tried the installation yourself and failed, the installation is NOT free, and furthermore IMPROPER INSTALLATION WILL VOID THE WARRANTY ON THIS PRODUCT.

Warning!

THIS WARNING IS EXTREMELY IMPORTANT IF YOU WILL BE USING A VIDEO CARD WITH THE GEMINI ULTRA CARD:

You MUST use the TOTAL SYSTEMS model V3000 adapter card with the Gemini Ultra accelerator card.

Using an early model of TOTAL SYSTEMS adapter card (model V2200 or earlier) instead of the correct model V3000 adapter card WILL SEVERELY DAMAGE your Gemini Ultra card, your video card, and/or your Macintosh!

Model V2200 adapter cards are labeled "TOTAL SYSTEMS Video Expansion Kit". Model V3000 adapter cards are labeled "TOTAL SYSTEMS GEMINI ULTRA VIDEO EXPANSION KIT" just below the P2 connector. A chip labeled "V3000" is inserted in the socket at U1. There are TWO, rather than ONE, rust-colored 90° connectors at the left end of the adapter card.

Make sure you have the correct adapter card before proceeding with installation. IF YOU DON'T, CALL TOTAL SYSTEMS FOR ASSISTANCE. USING THE WRONG ADAPTER CARD WILL VOID YOUR WARRANTY.
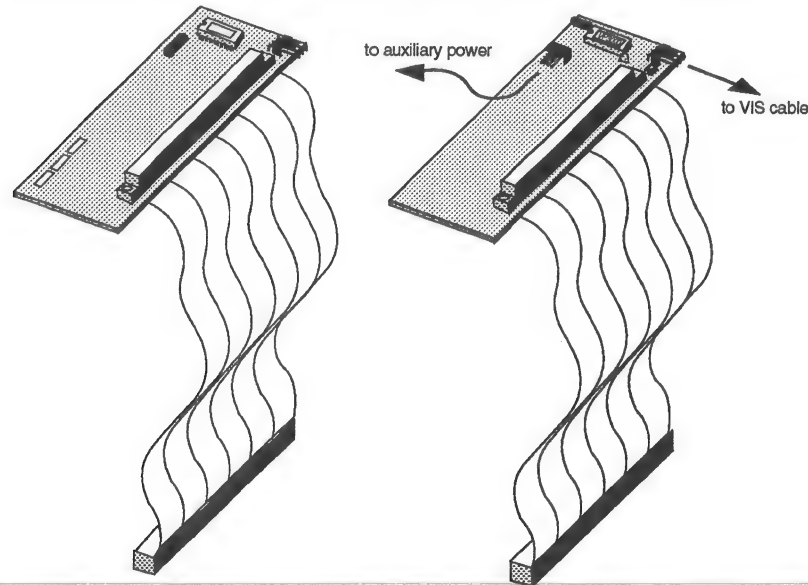

to auxiliary power

to VIS cable

Figure 1-1   V2200 adapter card   V3000 adapter card

Visual cues and conventions

Look for these cues throughout the manual:

☐ These convenient check boxes have been provided to ensure that you don't leave out any steps. Check off the steps as you complete them.

> **NOTE**   Notes like this contain important additional information

Warnings like this direct your attention to something that could cause injury, damage to software or hardware, or cause a loss of data.

Warning!

Instructions which require you to make a decision about which course of action to take are shown like this:

☞ If you want to install the Gemini Ultra using the Killy clip mounting....

Video Installation ONLY

If you are installing a Galileo external display system with your accelerator, follow these special instructions. If not, skip over them.

NOTE Throughout this manual, we refer to the Macintosh Plus, Macintosh 512K, and Macintosh 512K enhanced computers collectively as the *Macintosh Plus*.

The primary differences between these machines, besides RAM capacity, are that the Macintosh 512K enhanced computer was manufactured with 128K ROMs, like those in the Macintosh Plus, and was additionally fitted with an 800K internal floppy disk drive.

Earlier Macintosh 512K computers must have their 64K ROMs replaced with 128K ROMs, in order to operate correctly with the Gemini Ultra. The 128K ROMs are available from your Apple dealer, part no. 630-5218.

There were three versions of the 128K ROMs. The third version is the best compatibility with SCSI devices, particularly with slower or older hard drives. If you have version one or version two ROMs, it may be necessary to upgrade.

Gemini Ultra RAM options

SIMMs

RAM is added to most Macintosh models in the form of Single In-line Memory Modules (**SIMMs**), which provide a convenient, transportable method of connecting memory chips to the computer. SIMMs are available in 1MB, 2MB, 4MB and 16MB sizes for the Macintosh, but 2MB and 16MB SIMMs often use non-standard physical dimensions. Gemini Ultra does not currently support 2MB SIMMs.

SIMMs come in two "flavors" — surface-mounted SIMMs (SOJ, or low-profile SIMMs), and DIP SIMMs. At one time, DIP SIMMs were easier to find than surface-mounted SIMMs. However, DIP SIMMs are larger than surface mount SIMMs, and are too large for use on the Gemini Ultra. The Gemini Ultra therefore requires the use of surface-mount SIMMs.

RAM capacity — Gemini Ultra

The Gemini Ultra contains four SIMM sockets. When installing RAM, **all four sockets must be occupied, using SIMMs of the same size.** It can be configured with 4MB, 16MB or 64MB of RAM, using either 1MB, 4MB or 16MB SIMMs. This is because the 68030 CPU works with memory 32 bits at a time, and each SIMM provides 8 bits of the 32, or one quarter of the total.

If you have installed 4MB of RAM on the Gemini Ultra, and there is space available on your hard disk, VIRTUAL lets you use some of the free space as if it were additional RAM. Using virtual memory is cheaper than buying 4MB SIMMs, but there is a performance penalty which may or may not be acceptable to you.

Memory on the Macintosh main logic board is not used as part of the available application memory for performance reasons, but *can* be used as a RAM disk, using VIRTUAL.

Please see **Using Gemini Ultra** on page 6-1 for more information about using VIRTUAL and setting up a RAM disk.

NOTE   Limitations in the Macintosh ROMs make it necessary to use specialized memory-management software, like VIRTUAL, to take advantage of RAM sizes of more than 4MB.

RAM capacity — Macintosh Plus, Macintosh SE

The Macintosh Plus and Macintosh SE computers have four SIMM sockets, and the hardware on the main logic board can use either 256K SIMMs or 1MB SIMMs. These Macintosh computers are therefore limited to a maximum RAM capacity of 4MB. If different SIMM sizes are used, they must be used in pairs. Because of this restriction, the only permitted main logic board options are 1MB, 2MB, 2.5MB, or 4MB of RAM.

NOTE	The main logic board must be configured with at least 512K. It will not work without memory, even though RAM is installed on the Gemini Ultra board.

Make sure the main logic board is configured with lleast 512K of RAM. Refer to the chart of resistor saettings if you have changed theamount of memory on the main logic board. In order to install the Gemini Ultra, you must have surface mounted SIMMs installed on the main logic board. Larger DIP SIMMs have too high a profile and will not allow the Gemini Ultra to be installed.

Configuration	512K	1MB	2MB	2.5MB	4MB
Mac Plus R8 (150Ω)	join	join	cut	cut	cut
Mac Plus R9 (150Ω)	join	cut	join	cut	cut
SE resistor version R35 (150Ω)	join	join	cut	cut	cut
SE resistor version R36 (150Ω)	join	cut	join	cut	cut
SE jumper version	not connected	1MB position	2/4MB position	not connected	not connected

RAM capacity — Macintosh 512K enhanced, Macintosh 512K

The Macintosh 512K enhanced or Macintosh 512K computer is limited as standard to a maximum RAM capacity of 512K on the main logic board.

With the Gemini Ultra configured to 4MB or 16MB of RAM, the memory remaining on the main logic board of the Macintosh is only available using VIRTUAL as a RAM disk. If the Gemini Ultra is disabled, the standard 68000 processor will use the RAM on the main logic board as usual.

> **NOTE**   Before fitting the Gemini Ultra to an original Macintosh 512K computer, the original 64K ROMs on the main logic board must be replaced with 128K ROMs (Apple part no. 630-5218).

How fast is your RAM?

RAM chips are produced with a variety of access times, measured in nanoseconds. Nanoseconds measure the RAM response to data requests from the CPU. Shorter access times mean higher operating speeds.

RAM speed ratings are stamped (as a suffix to the part number) on the chips by the manufacturer, indicating the fastest speed at which the memory is **guaranteed** to operate. At the end of the part number is a hyphen, followed by a one- or two-digit number. The number indicates the speed at which the RAM is certified to run, measured in tens of nanoseconds. If the part number ends with "-12", for example, the RAM is certified to meet 120ns standards. Smaller numbers indicate faster RAM. Most SIMMs purchased after-market contain 80ns RAM or faster. The 80ns SIMMs are commonly marked with the suffix "-8" or "-80."

RAM chips rated at speeds of as little as 60ns are currently available. RAM chips are rated on a batch basis as they are produced, so individual chips may actually work successfully at higher speeds than suggested by the manufacturer's rating. However, this can only be discovered by trial and error, and at the risk of losing data.

If a processor runs faster than the RAM can supply data to it, errors such as corrupted data, system bombs or a "Sad Mac" will occur on startup.

To avoid these problems, while enabling fast processors to run with slow memory, the processor can be configured to wait for 1, 3 or 5 of its internal clock cycles every time it

requests data from RAM, allowing time for slow RAM to deliver the data before proceeding. These delays are called "wait states." The consequence of introducing these wait states is simply that the performance of the processor is slightly reduced.

Gemini Ultra upgrade options

There are a number of upgrade options for your Gemini Ultra and Macintosh.

☛ If your Gemini Ultra does not currently use a math coprocessor, and you do a lot of intensive numerical calculation, consider adding a 68882 math coprocessor.

• The math coprocessor speeds up SANE floating-point math calculations up to 350 times.

• Adding a 68882 math coprocessor to the Gemini Ultra is as simple as plugging the new processor chip into its socket.

☛ If your Gemini Ultra is currently configured with 4MB of RAM using 1MB SIMMs, you may wish to replace the 1MB SIMMs with larger-capacity 4MB SIMMs, for a total of 16MB of RAM.

• As 16MB SIMMs become available in the same physical dimensions as existing standards, and their prices reach affordable levels, these may also be fitted.

• Additional RAM lets you run more applications concurrently with System 7.0, (or with MultiFinder in System 6.0.7), which improves your work flow by letting you move more quickly between tasks without waiting to quit-then-start each successive application.

• Additional RAM can help you get faster performance with a large RAM disk. You can combine RAM from the main logic board of your Macintosh with RAM from your Gemini Ultra accelerator. See **Using the Gemini Ultra**, on page 6-1 for more information.

• With more RAM, you can achieve faster performance by creating a larger disk cache, speeding up repeated access to information on a disk dramatically. See **Using the Gemini Ultra**, on page 6-1 for more information.

• Upgrading SIMMs is simple: just snap out the existing SIMMs, then plug new, larger SIMMs into your Gemini Ultra. The Gemini Ultra automatically configures to the amount of RAM installed.

☞ If you wish the screen of your Macintosh were less cluttered, letting you see more of your data, or open additional windows, consider adding a one- or two-page external display system.

• The combination of a *fast* computer with lots of screen "real-estate" is truly liberating! This is probably the most compelling upgrade step you can take after accelerating your Macintosh — once you've tried it for a week, you'll never want to go back to a cramped 9-inch screen.

• To do this, you need a TOTAL SYSTEMS external display system. An external display system includes a monitor, a video card to drive the monitor, and appropriate cabling. Contact TOTAL SYSTEMS for more information.

Warning!

The adapter card modules for the Gemini Ultra are specifically designed for use ONLY on the Gemini Ultra. Older adapter cards, designed for use with previous Gemini accelerators, are NOT compatible with the Genmini Ultra, even though the same monitors may be compatible.

Transferring the Gemini Ultra between machines

The Gemini Ultra may be transferred between the SE, Plus and 512KE. Transferring *to* the SE requires no additional equipment, while transferring *from* the SE requires the addition of the PlusKit, available from TOTAL SYSTEMS.

Gemini Ultra mounting options

The Gemini Ultra simply plugs into the the expansion slot of the main logic board of the Macintosh SE.

The Gemini Ultra is connected to the main logic board of the Macintosh Plus by mounting onto the legs of the 68000 processor, located near the center of the main logic board. There are two methods of attaching the Gemini Ultra to these computers:

1. You can attach a clip-on connector (referred to as a Killy™ clip) to the 68000 processor. This heavy-duty plastic clip locks down securely onto the 68000, and uses spring contacts to connect to each leg of the 68000 CPU. The top of the Killy clip has a set of pins which connect to the Gemini Ultra. (There is also a spacer between the Gemini Ultra and the Killy clip, to provide extra clearance between the accelerator card and the main logic board.)

Advantages:

- Faster, easier installation of the Gemini Ultra, since no soldering is required.
- Minimal risk of damaging the 68000 processor or the main logic board.
- Easier to remove if you wish to transfer your Gemini Ultra to another Macintosh.

Disadvantages:

- The electrical contact between the Killy clip and the 68000's pins may not be as good as a professional-quality soldered connection.

- If the Killy clip is installed incorrectly, it can eventually develop a bad connection due to the expansion and contraction caused by heating and cooling inside the Macintosh.

2. You can solder two 32-pin spacer sockets to the legs of the 68000 processor, pointing upwards. The Gemini Ultra attaches to the pins using an additional spacer socket.

NOTE It is recommended that the solder-pin modification be installed at the factory or by an authorized TOTAL SYSTEMS dealer.

Advantages:

- If the soldering is done well, this yields the highest quality electrical contact between the 68000 and the Gemini Ultra. **This is the recommended choice for long-term reliability.**

Disadvantages:

- If the soldering is done by unskilled persons, or with improper equipment, or is not done carefully, the accelerator card may not work and the 68000 processor or the main logic board could be damaged by accidental overheating or electrostatic discharge (ESD).

- In most cases, not a customer-installed option.

- Requires high quality soldering equipment.

- The solder-pin modification will void your AppleCare warranty, if you have purchased this service.

High-speed SCSI interface

The Gemini Ultra provides early Macintosh computers with a high-speed interface capable of fast reads and writes speeds. Depending on the specifications of the hard disk you use, the Gemini Ultra's high-speed SCSI interface can transfer data considerably faster than the standard SCSI port built into the Macintosh Plus.

GemFan internal fan

The Macintosh Plus is passively cooled, and runs rather hot. The internal GemFan is provided to cool installed Gemini Ultra cards on the Macintosh Plus.

Many owners of these computers have already added a fan to their machines to reduce the average internal temperatures and prolong the life of the computer's components. If you have already installed an *internal* fan, it may be physically incompatible with the GemFan/GemPower assembly. Use the GemFan/GemPower system instead. If you are using an *external* fan, by all means continue to use it — there is no such thing as an over-cooled Macintosh. The GemFan/GemPower assembly is not required with the Macintosh SE.

Warning!

Piezoelectric or other oscillating fans do not provide adequate cooling when the Gemini Ultra is installed, and must be supplemented or replaced with the GemFan.

GemPower DC auxiliary power supply

An auxiliary DC power supply is included with Macintosh Plus installation kits, which provides a constant +5 volt supply to operate the Gemini Ultra, without overloading the standard Macintosh power supply. The GemPower auxiliary supply is not required with the Macintosh SE.

Notice to Installers

Warning!

Potentially life-threatening voltages may exist inside your Macintosh, even with the power cord disconnected.

TOTAL SYSTEMS is not responsible for any damage to either your Gemini Ultra or to your Macintosh due to incorrect installation.

In addition to a standard ESD-safe work area, Macintosh Plus installations using the solder–pin modification mounting instead of the Killy clip require above-average soldering skills. A grounded–tip, temperature controlled soldering iron with a small tip is also required. Extensive damage to the Macintosh main logic board or the Gemini Ultra can occur if you overheat the components being soldered, or use a soldering iron without these features.

> **NOTE** The term "Using standard Apple procedures" within these instructions indicates that you are required to perform various standard Macintosh servicing operations covered by Apple Level 1 Technician certification. These operations include removing the rear case half, unplugging the internal cables, removing the main logic board and observing static discharge precautions.

Warning!

Installing the accelerator card, adapter card and video card components of your external display requires basic mechanical skills. Also note that the Macintosh contains components that may retain a high-voltage charge for some time after the computer has been turned off. Touching one of these parts incautiously can cause personal injury or damage to your Macintosh.

FREE INSTALLATION is offered on all TOTAL SYSTEMS products. (Shipping charges are not included in this offer.)

If you are uncertain about your ability to install the accelerator card, adapter card or video card yourself, please take advantage of this FREE INSTALLATION OFFER. Contact TOTAL SYSTEMS at 1-800-874-2288 for an authorized TOTAL SYSTEMS dealer in your area, or for a factory installation.

If you have already tried the installation yourself and failed, the installation is NOT free, and furthermore IMPROPER INSTALLATION WILL VOID THE WARRANTY ON THIS PRODUCT.

READ ME document

Your GemStart disk includes a document called **READ ME**, describing any changes that may have been made to the procedures, compatibility, or product specifications since this manual was printed. Please be sure to read this document.

If you would like to find a certified installer in your area, or if you would prefer that TOTAL SYSTEMS install your Gemini Ultra, contact TOTAL SYSTEMS directly.

Required Equipment

To install your Gemini Ultra, you'll need:

Static-safe work area

15" Torx® screwdriver

Phillips screwdriver

2 medium flat-blade screwdrivers

Case separation tool

Small file, Exacto®knife or equivalent

DC volt meter (not required for Macintosh SE)

Optional Equipment

Task	Equipment
Install 68030 CPU/68882 FPU	Plastic or rubber-coated vise
Install GemFan on a Macintosh 512K or Macintosh Plus	Phillips screwdriver
	3/16" nut driver
Removing Killy Clip for troubleshooting	2 medium flat-blade screw-drivers
Soldered pin modification on Macintosh Plus main logic board	Temperature-controlled soldering iron with small, grounded tip; toothbrush; isopropyl alcohol

Optional Video Installation Equipment

6mm (3/16") nut driver

IC chip-pulling tool (usually not required)

Warranty Registration

At TOTAL SYSTEMS we are constantly striving to improve the performance of our products. We will work to enhance further the performance of your Gemini Ultra, and the range of third-party products with which it is compatible.

Your purchase of this product entitles you to receive, free of charge for one year, any software or firmware upgrades which may become available to enhance the performance of your accelerator card or to enhance its compatibility with third-party products. You may be required to pay a small shipping and handling charge to cover the cost of distributing these upgrades.

> **NOTE** You will not be able to receive notification of upgrades, or other information concerning your Gemini Ultra, unless you fill out and return the Warranty Registration card enclosed in the original package. Please complete and send the warranty card now, if you have not already done so.

Preparing Gemini Ultra for Installation

Installing processors

If your Gemini Ultra has not had its 68030 processor or 68882 math coprocessor installed at the factory, you must first install the chips yourself.

Orientation

Orient the Gemini Ultra so that the legend "TOTAL SYSTEMS GEMINI ULTRA™" reads from left to right.

Installing a 68030 CPU

If your Gemini Ultra has not had its 68030 processor installed at the factory, you must first install it yourself.

☐ 1. Carefully place the 68030 processor in socket U1, with the orientation arrow on the processor pointing to the small white dot near the *upper left* corner of the socket. Ensure that all the pins are correctly positioned, and that none are bent away from the holes in the socket.

☐ 2. Press down on the processor firmly, keeping the chip even as it moves down into the socket.

☐ 3. Use a plastic or rubber-coated vise to fully seat the processor in its socket.

Installing a 68882 FPU

If your Gemini Ultra has not had its 68882 math coprocessor installed at the factory, you must install it yourself.

□ 1. Carefully place the 68882 math coprocessor in socket U15, with the orientation arrow on the processor pointing to the small white dot near the *upper right* corner of the socket. Ensure that all the pins are correctly positioned, and that none are bent away from the holes in the socket.

□ 2. Press down on the processor firmly, keeping the chip even as it moves down into the socket. Finger pressure is all that is required to properly seat the math coprocessor.

Setting DIP switches

When first installing the Gemini Ultra, **check the DIP switch settings**—make sure they're appropriate for your particular situation. If you experience problems, experiment with new DIP switch settings.
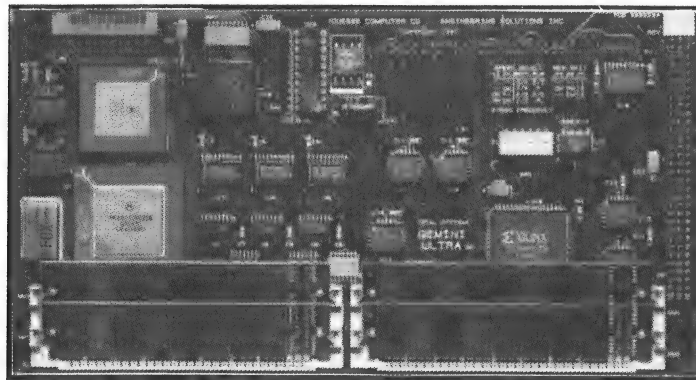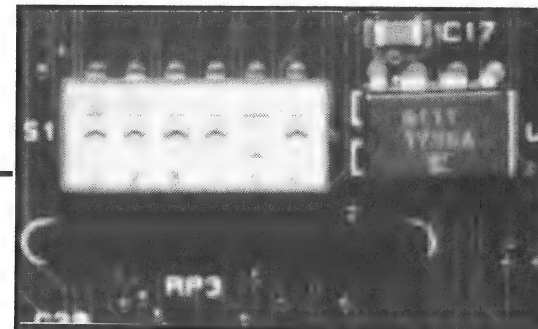

Figure 2-1   *Orientation of the Gemini Ultra*   *DIP switch location*

☐ 1. Confirm that DIP switches 1 and 2 are set correctly for your configuration.

Function	DIP Switch 1
Accelerator card OFF	*Off*
Accelerator card ON *[Factory default]*	*On*

Function	DIP Switch 2
High-speed SCSI interface OFF *[Use with Macintosh SE]*	*Off*
High-speed SCSI interface ON *[Use with Macintosh Plus]*	*On*

Figure 2-2—Table for DIP switches 1 and 2

Setting the number of Wait States

☐ 1. Use this table to determine the correct number of wait states for your accelerator card with the SIMMs you are using.

RAM Speed	20MHz Operating Speed	25MHz Operating Speed	33MHz Operating Speed	40MHz Operating Speed	50MHz Operating Speed
60ns	1	1	1 or 3	3	5
70ns	1	1 or 3	3	3 or 5	5
80ns	1	3	3	5	NR*
100ns	3	3 or 5	5	NR*	NR*
120ns	3 or 5	5	NR*	NR*	NR*
150ns	5	NR*	NR*	NR*	NR*

*Not recommended

Figure 2-3—Table for DIP switches 5 and 6

Warning!

About 40% of RAM tested can operate successfully at fewer wait states than indicated by the manufacturer's rating. About 40% cannot operate beyond specification in this way. The remaining 20% appears at first to operate properly, but may fail once it has warmed up. If you experiment with running RAM faster than specifications, save files frequently as you work — until you are quite sure that your system operates reliably for extended periods.
There is no guarantee that your system will not crash unexpectedly if you select fewer wait states than recommended.

☐ 2. Now set DIP switches 5 and 6 for the correct number of wait states.

Wait States	DIP Switch 5	DIP Switch 6
1	Off	Off
3	On	On
5	Off	On

Figure 2-4—Table for DIP switches 5 and 6

Setting Startup Speed and Operating Speed

Your Gemini Ultra can be configured to start up and to operate at different speeds. Some older hard drives, and some poorly-written driver software, may have difficulty responding quickly enough to the accelerated startup sequence of the Gemini Ultra — though the vast majority of drives marketed today have *absolutely no problem* working with the Gemini Ultra at full operating speed.

Disk driver software is also an important factor. Budget drives often depend on less robust, less efficient driver software.

How it works

The clock crystal, located at the front right corner of your Gemini Ultra, functions with DIP switches 3 and 4 to determine the speeds at which the accelerator card runs.

DIP switch 3 lets you select startup speed at half or quarter of the clock crystal speed. Ordinarily, you'll want to start up at half speed, but you may find it necessary to run at quarter clock speed.

When GemStart executes during start up, it reads the setting of DIP switch 4, and adjusts the operating speed of the accelerator to half or full clock speed as appropriate.

☐ 1. Set DIP switches 3 and 4 to provide the correct startup and operating speeds for your configuration.

Startup Speed	Operating Speed	DIP Switch 3	DIP Switch 4
Quarter Clock	Half Clock	Off	Off
Quarter Clock	Clock	Off	On
Half Clock	Half Clock	On	Off
Half Clock	Clock	On	On

Figure 2-5—Table for DIP switches 3 and 4

NOTE   All 20MHz accelerators are fitted with *40MHz* crystals, and in order to run successfully, DIP switch 4 *must* be OFF.. If you set this switch incorrectly, you'll experience crashes when GemStart tries to changes speeds during start up .

Installing SIMMs

All four SIMM holders on the Gemini Ultra must contain the same size SIMM — either 1 MB, 4 MB or 16MB apiece.

NOTE Not all SIMMs were created equally. There are a few brands that do
      not rate as fast as they claim. You may have set DIP switch 5 & 6
      correctly, according to the labels on the chips– but unfortunately,
      problems may occur. If so, try increasing the number of wait states.

☐ 1. Vertically insert the first SIMM module into the SIMM slot closest to the middle of the
       board and rotate it to a forty-five degree angle. Clip the SIMM module to its slot by
       pressing forward on the sides of the module. **Make sure** the base of the SIMM is fully
       seated in the socket—it's quite easy to put them in slightly askew.

☐ 2. Repeat this process to install the remaining three SIMM modules.

Macintosh SE and U20 Socket

On Gemini Ultra cards installed in the Macintosh SE, socket U20 may be empty. Don't be
alarmed — nothing is wrong! This component is needed for Macintosh Plus installations
only. However, if U20 *is* installed, don't bother to remove it; DIP switch 2 will override it.

Installing Gemini Ultra on the SE

Preparing the Macintosh SE

Prior to installing the Gemini Ultra into your Macintosh, back-up your hard drive.

Using standard Apple procedures:

☐ 1. If installed, remove the programmer's switch from the lower left side of the Macintosh, as shown in Figure 3-1.
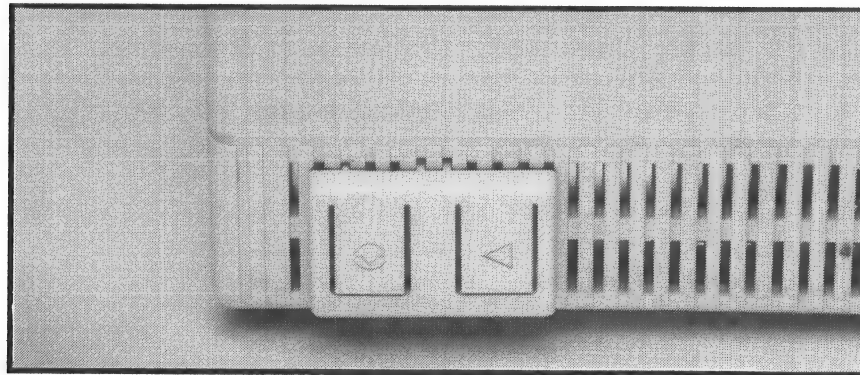

Figure 3-1   Macintosh SE programmer's switch

☐ 2. Locate and remove the four case screws on the back of the Macintosh using the Torx® screwdriver. Two are hidden uderneath the handle on top of the Macintosh.

☐ 3. Using the case separation tool, insert the jaws into the groove that extends around the top and sides of the machine. Gradually increase the pressure until the front of the case separates from the back. Repeat this step around the case until loosened.
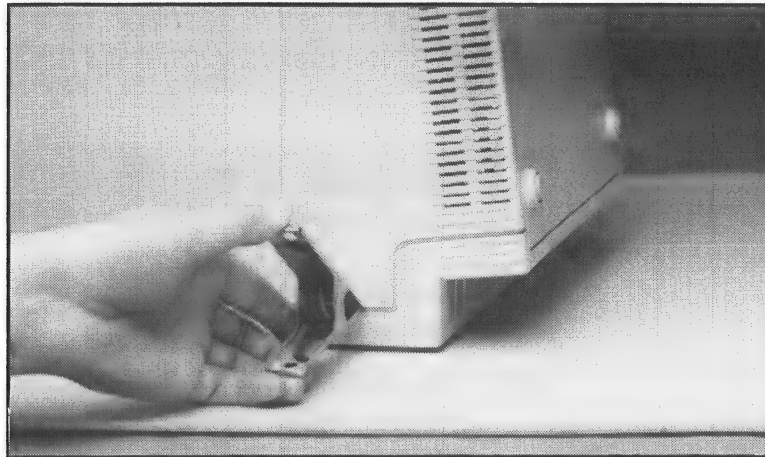

Figure 3-2 Macintosh case separation

☐ 4. Remove the foil RFI shield from below the main logic board.

☐ 5. Carefully pull the small CRT driver card back off the end of the CRT. Be sure to keep it straight, as any rotational torque may puncture the CRT.
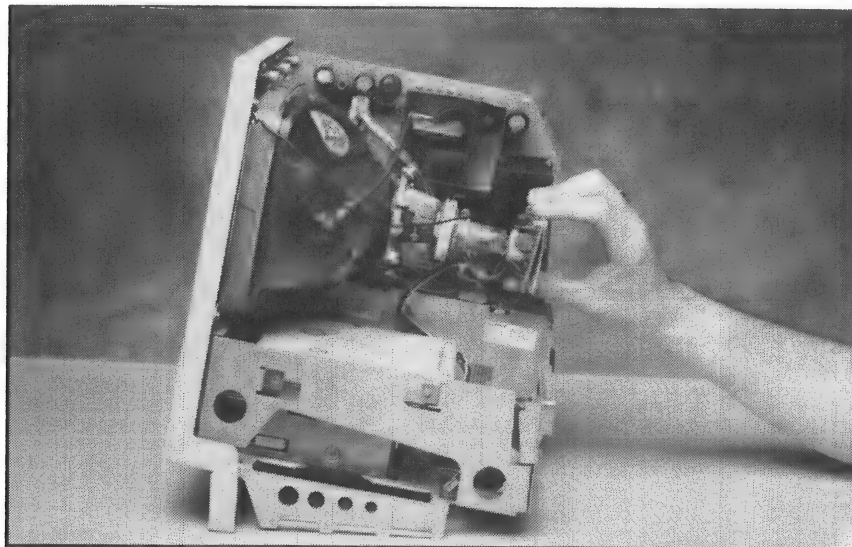

Figure 3-3 CRT driver card removal

☐ 6. Disconnect the small, gray ribbon cable (with either a red or yellow stripe on one side) connecting the floppy drive cable to the main logic board.
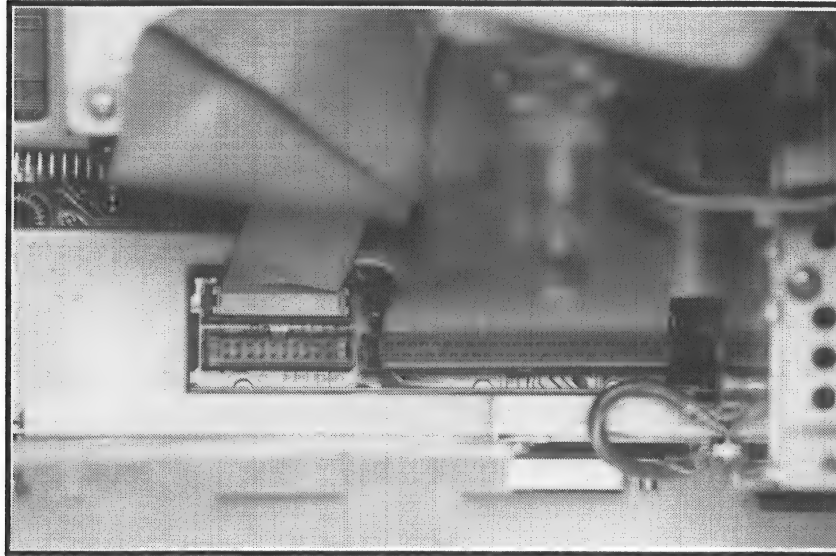

Figure 3-4   Disk drive cables

☐ 7. If an internal hard disk is present, disconnect its SCSI cable in the same way as in Step 6.

☐ 8. Disconnect the main power cable from the main logic board by depressing the catch on the plastic connector with your left index finger and grasping the cable with your right hand, pulling directly away from the main logic board. You can use a flat blade screwdriver as a lever to help unseat the cable connector—just make sure the catch is free first.
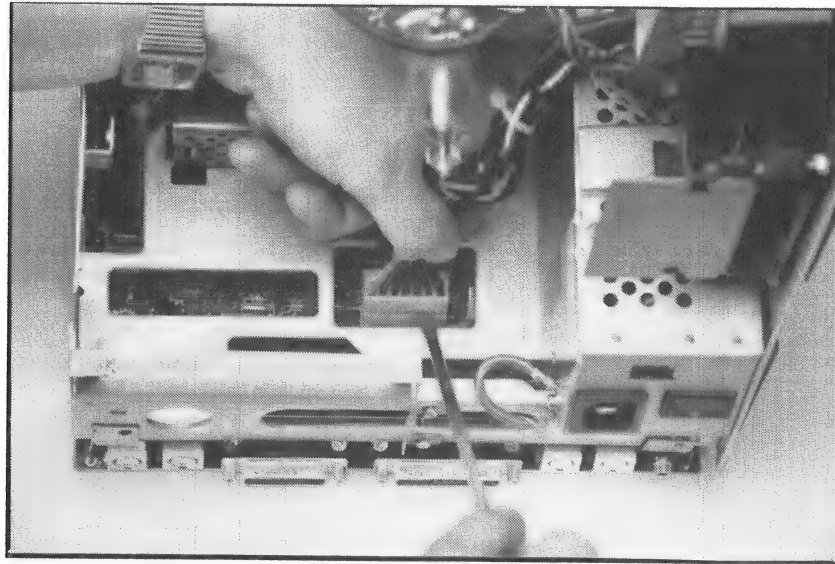

Figure 3-5   Main power cable

☐ 9. Pull the main logic board out of the chassis. Detach the speaker cable.

☐ 10. Remove the floppy drive screws underneath the chassis.

The housing is securely retained at each end by two other screws and special lugs, which hold it in place; the two additional screws are redundant, and must be removed to prevent a clearance problem with the SIMMs on the accelerator card.
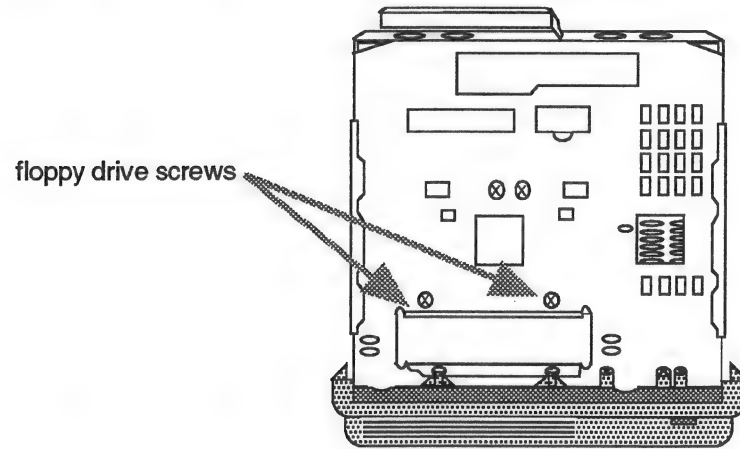

Figure 3-6 Removing floppy drive screws

The red clip

The adapter card requires a +5V DC connection to the main logic board. The red clip attaches to component C22 on the main logic board and provides this +5V DC source. Make sure you attach it to the correct side of component C22. After you have attached the red clip, tuck it down amongst the components. If it is left standing upright, it will obstruct reinstallation of the cards into the chassis.
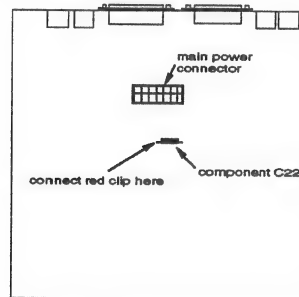

Figure 3-7   Macintosh SE main logic board

Mounting Gemini Ultra onto the main logic board

The Gemini Ultra mounts onto the main logic board of the Macintosh SE using its expansion slot at one end, and two plastic standoffs for support at the opposite end.

☐ 1.   At the other end of the accelerator card, you'll find two holes in the corners of the circuit board. One hole is adjacent to the accelerator's SIMMs. Plug the **black-tipped** plastic stand-off into this hole; the base of the standoff sits next to the SIMM socket on the main logic board—depending on manufacturing tolerances, the standoff may rest at a slight angle to clear the lower socket. Plug the **white** plastic stand-off into the other hole, which is near the FPU socket; the base of the standoff fits into a corresponding hole on the main logic board.

☐ 2.   Make sure the accelerator card connector mounts flush with the expansion slot.

Warning!

Using an early model of TOTAL SYSTEMS adapter card (model V2200 or earlier) instead of the model V3000 adapter card <u>WILL SEVERELY DAMAGE</u> your Gemini Ultra card, your video card, and/or your Macintosh!

Model V2200 adapter cards are labeled "TOTAL SYSTEMS Video Expansion Kit". Model V3000 adapter cards are labeled "TOTAL SYSTEMS GEMINI ULTRA VIDEO EXPANSIONKIT" just below the P2 connector. A chip labeled "V3000" is inserted in the socket at U1. There are <u>TWO</u>, rather than <u>ONE</u>, rust-colored 90° connectors at the left end of the adapter card.

Make sure you have the correct adapter before proceeding. Using the wrong adapter card will <u>VOID</u> your warranty. Do not use the Gemini Ultra V3000 adapter card with a Gemini 020\030, Gemini II, or Mercury 030 card. The results will be equally dire! Contact TOTAL SYSTEMS for assistance if you suspect you have an inappropriate video adapter card for your application.

Hardware Installation

Preparing the V3000 adapter card assembly

The V3000 adapter card is usually shipped from TOTAL SYSTEMS with the angled metal mounting bracket pre-assembled as shown in Figure 3-8 (on the next page). However, if you have purchased these components separately, fit them together now.
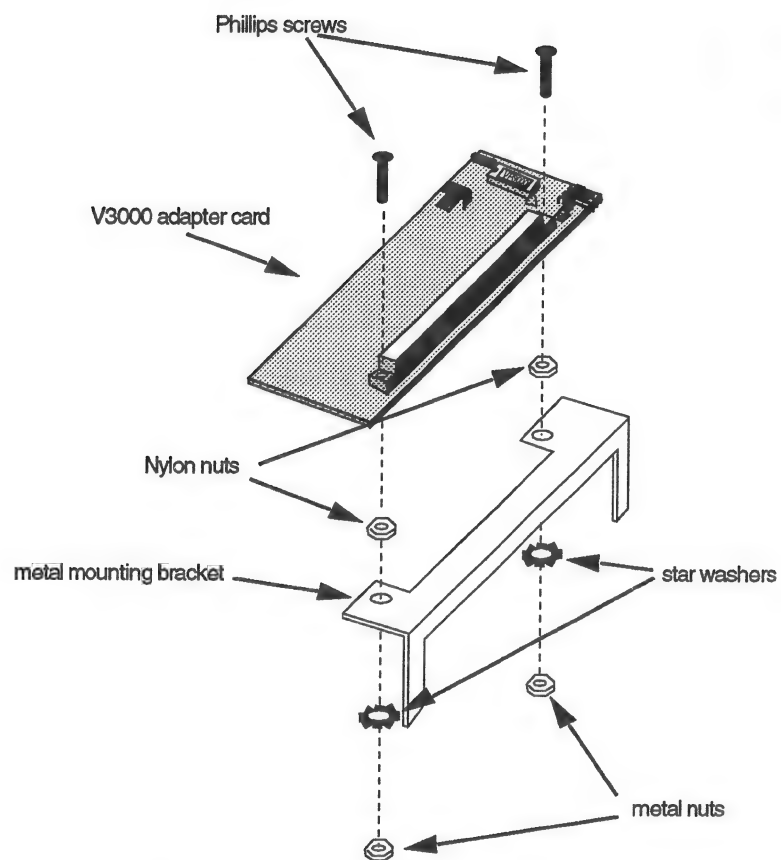
**Video Installation
ONLY**

Phillips screws

V3000 adapter card

Nylon nuts

metal mounting bracket

star washers

metal nuts

Figure 3-8   Adapter card and bracket assembly

Installing the adapter card

☐ 1. Position the **V3000 adapter card** between the **SE expansion bracket** and the rear of the disk drive area, so that its **64-pin ribbon cable** points downwards towards the lower chassis, as shown in Figure 3-8.

☐ 2. Direct the small ribbon cable from the **output plate** out towards the right-hand side, where it will eventually be attached to the Galileo video card.

☐ 3. Fasten the **V3000 adapter card** assembly and the **output plate** to the **SE expansion bracket** using the screws and nuts provided, as shown in Figure 3-8.

☐ 4. Tape any sharp edges of the chassis which might abrade the ribbon cable.

☐ 5. Carefully route the **64-pin ribbon cable** down through the rectangular slot in the chassis, just behind the floppy drive. The cable is pre-cut to compress slightly as it passes through the slot. Connect the **64-pin ribbon cable** from the adapter card to the accelerator's P4 connector. This is often a tight fit; make sure you have lined up the connectors correctly, then press firmly and with patience.

☐ 6. Feed the red clip through the same slot the main power cable is routed through, and tuck the body of the clip down out of the way.

☐ 7. Connect the red clip to the P3 plug on the adapter card.

> **NOTE**   One edge of the 64-pin ribbon cable from the V3000 adapter card carries a red stripe, which must match up with Pin 1 on the accelerator card. Near the connector, you will find a legend identifying P4—the legend is at the Pin 1 end.

☐ 8. While moving the assembled accelerator and main logic board towards the chassis for installation, carefully pull the slack in the 64-pin ribbon cable up through the slot in the chassis. Compress the cable slightly to avoid abrading its edges against the sides of the slot.

V3000 adapter card
with mounting bracket

SE power supply

metal nuts with
washers attached

screws

SE
expansion
bracket

output plate for
Full-Page Displays

rectangular slot in SE chassis

64-pin ribbon cable from adapter card to accelerator

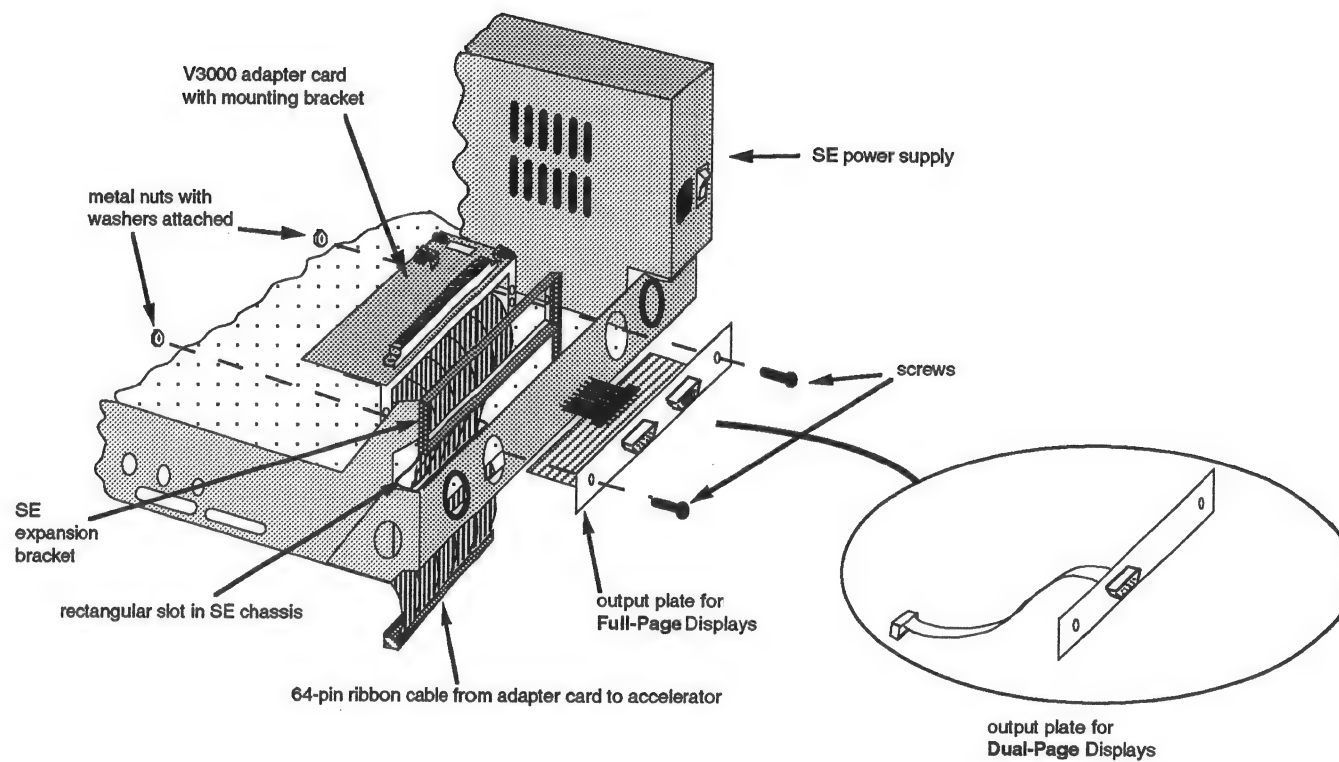output plate for
Dual-Page Displays

Figure 3-9   Positioning the adapter card and output plate

Reinstalling the main logic board

☐ 1. Place the left edge of the main logic board inside the metal guide rails, and swing the board, as if closing a door, toward the right guide rails. See Figure 3-10.

> **NOTE** DO NOT try to slide the whole assembly back along the chassis rails; the two units are too high to fit. Position the main logic board parallel to the frame rails.

☐ 2. Reconnect the speaker cable and internal power cable to the main logic board.

☐ 3. Carefully spread the metal guide frame on the right side, where the main logic board is not yet inserted, by inserting a flat blade medium screwdriver between the main logic board and the frame until the main logic board "pops" into place.

☐ 4. With the main logic board successfully mounted inside the chassis guide rails, lower it into position the remaining 1/2" (13mm), until it is fully seated. Ensure the locking tags at the rear edge of the main logic board are properly engaged.
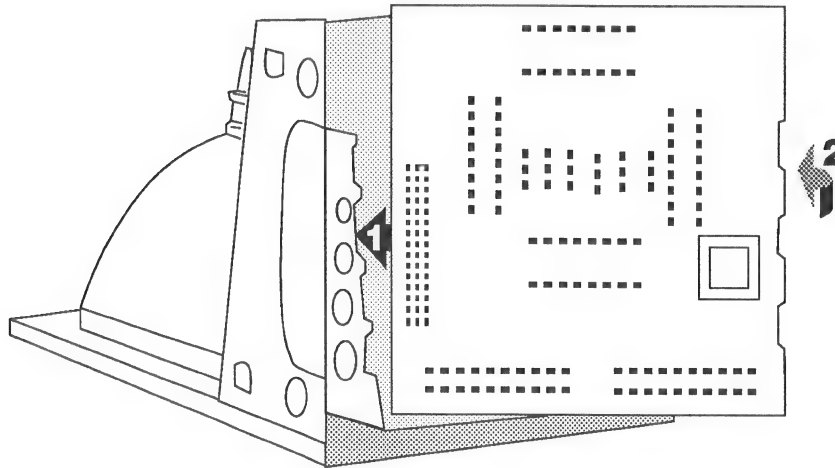
Figure 3-10   Mounting main logic board and accelerator into SE chassis

Pre-Testing the Installation

At this point, pre-test your work *before* putting the case back on and tightening the screws. Read the pre-test procedure through thoroughly, *before* you do it.

Warning!

WARNING

When power is applied, the ONLY shield protecting you from very high-voltage hazards is your COMMON SENSE!
Take GREAT CARE not to touch the CRT, the flyback transformer, or other exposed metal parts. Touch ONLY the power switch itself or the plastic front bezel.

☐ 1. Turn the Macintosh onto its face, so the screen rests on the work surface. Make sure the computer is well clear of other obstructions, tools, etc.

☐ 2. Plug in the power cable. Turn on the Macintosh.

☛ If the Macintosh makes **no** "boing":

1. IMMEDIATELY TURN OFF the power!

2. Remove the power cable BEFORE you proceed!

Probability: 80%   *As long as the power cable is actually providing power (is the far end still plugged into a live socket?) there is an open circuit or a dead short circuit. Confirm that the SIMMs on the accelerator card are not shorting against the chassis, and that the SIMMs on the main logic board are not shorting aginst the underside of the accelerator card.*

Probability: 19%   *Make sure the plastic standoffs are installed.*

---

3. Turn to the Troubleshooting section of Chapter 6 for more clues. Repeat the pre-test before you complete installation.

☛ If the Macintosh makes **a normal** "boing":

☐ 1. Tilt the Macintosh back at a 45-degree angle, pivoting it on the lower front edge of the chassis, so you can see the screen display. Hold it there by supporting it from the front fascia. Be certain you do NOT contact any live parts!

☐ 2. Inspect the display.

☛ If the display turns to a grey pattern, pauses, then shows a **flashing question mark** over a disk icon:

> *All is normal. Turn off the power, unplug the main power cable, and proceed with completing installation.*

☛ If the display shows a regular **pattern of black and white bars** (vertical or horizontal striped regions), **stays black**, or there is **some other display**:

Probability: 80%   *Confirm that the SIMMs on the accelerator card are not shorting against the chassis, and that the SIMMs on the main logic board are not shorting aginst the underside of the accelerator card.*

Probability: 15%   *There may be a problem in the connection between the accelerator and the main logic board*

☐ 3. Turn to the Troubleshooting section of Chapter 6 for more clues. Repeat the pre-test before you complete installation.

> **NOTE**   **Once the main logic board and Gemini Ultra are installed as described above, the main logic board cannot be removed by sliding it out on the guide rails. It can *only* be removed by reversing the above procedure.**

Completing the installation

☐ 1. Reconnect the hard disk cable.

☐ 2. Reconnect the internal power cable.

☐ 3. Test-fit the video card to the P2 connector on the adapter card. To prevent static damage, don't touch the components and traces; it's very static-sensitive. Experiment with where to position the adhesive rubber foot underneath, so that no part of the card touches the disk drive housing, the CRT, or any other part that could cause a short circuit. When you have found a suitable location for the foot, attach it permanently to the video card, then install the card.
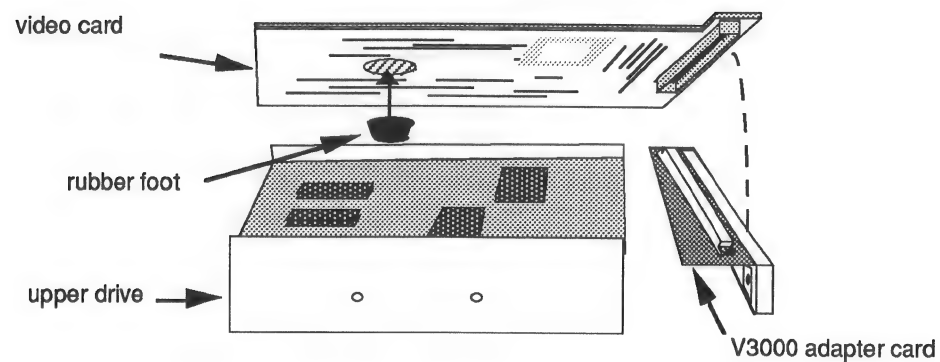
Video Installation ONLY

video card

rubber foot

upper drive

V3000 adapter card

Figure 3-11   Attaching rubber foot

☐ 4. Connect the free end of the video port cable to the video card. Make sure you plug the keyed connectors in correctly.

J5-ECL1

connection for Dual-Page Displays
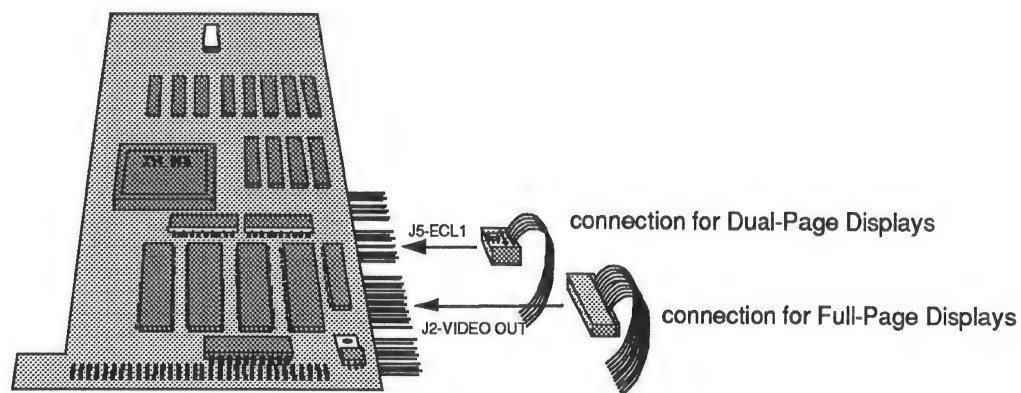
J2-VIDEO OUT

connection for Full-Page Displays

Figure 3-12   Proper connections for DPD or FPD cables

☐ 5. Carefully push the driver card back onto the end of the CRT. Don't apply rotational torque as you do this — the neck of the CRT is very delicate! The driver card is keyed, so that it will fit correctly ONLY one way.

☐ 6. Check to make sure all other connections are firmly seated. Replace the foil RFI shield, making sure it fits correctly around the ports at the rear of the main logic board. Replace the rear half of the Macintosh case and fasten the case screws.

☐ 7. Replace the programmer's switch, if needed.

☐ 8. Attach the "Service Note" decal to the rear of case and the "TOTAL SYSTEMS" decal to the front.

☐ 9. That's all — you're done with the hardware installation! Congratulations!

☐ 10. Connect the external display to the video output port on the back of the SE. Connect power to the Macintosh and external display. Turn on the external display.

☐ 11. Refer to the **Software** section on page 5-1 to install and configure the Control Panel software.

NOTE   Don't forget to send in your Warranty Registration card!

Installing Gemini Ultra on the Macintosh Plus

Prior to installing the Gemini Ultra into your Macintosh, back-up your hard drive.

Using standard Apple procedures:

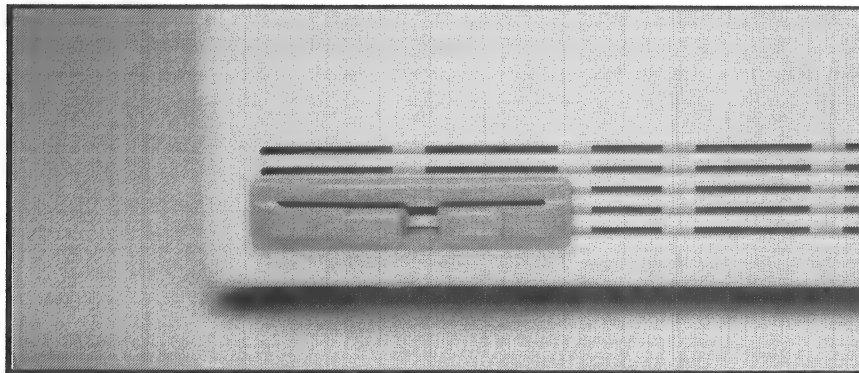☐ 1. If installed, remove the programmer's switch from the lower left side of the Macintosh.

Figure 4-1   Programmer's switch location on the Macintosh Plus

☐ 2. Locate and remove the five case screws on the back of the Macintosh using the Torx® screwdriver. Two are hidden underneath the handle on top of the Macintosh, and one is underneath the battery door.

☐ 3. Using the case separation tool, insert the jaws into the groove that extends around the top and sides of the machine. Gradually increase the pressure until the front of the case separates from the back. Work around the case until loosened.
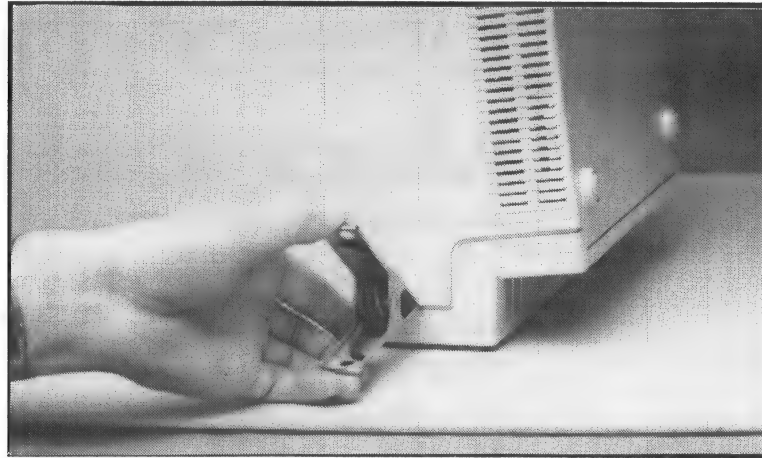

Figure 4-2   Case separation

☐ 4. Remove the foil RFI shield from below the main logic board.

☐ 5. Disconnect the small, gray ribbon cable (with either a red or yellow stripe on one side) connecting the floppy drive to the main logic board.

Figure 4-3   Floppy drive cable
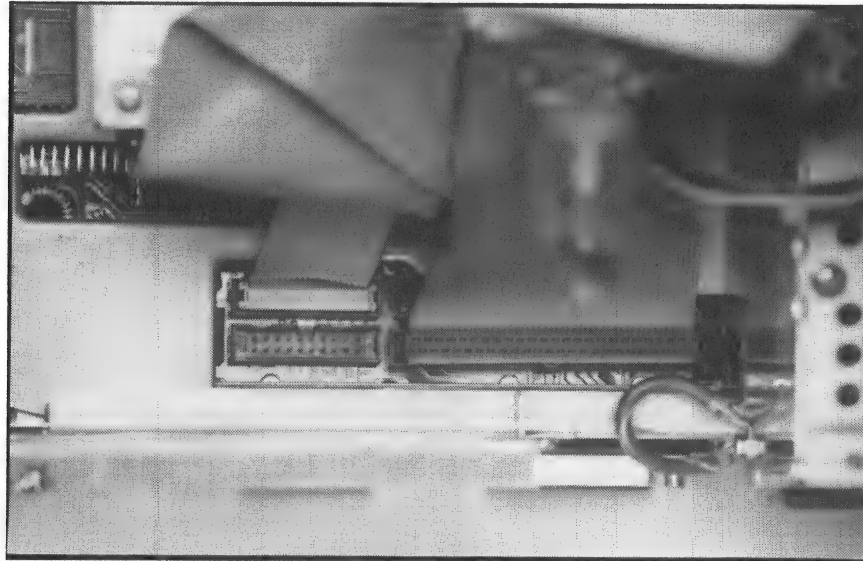
☐ 6. Disconnect the main power cable from the logic board by inserting a medium flat blade screwdriver through one of the holes in the back of the chassis. Fit the edge of the screwdriver into one of the slots in the power cable plastic housing. Gently pry the main power cable out from its socket.
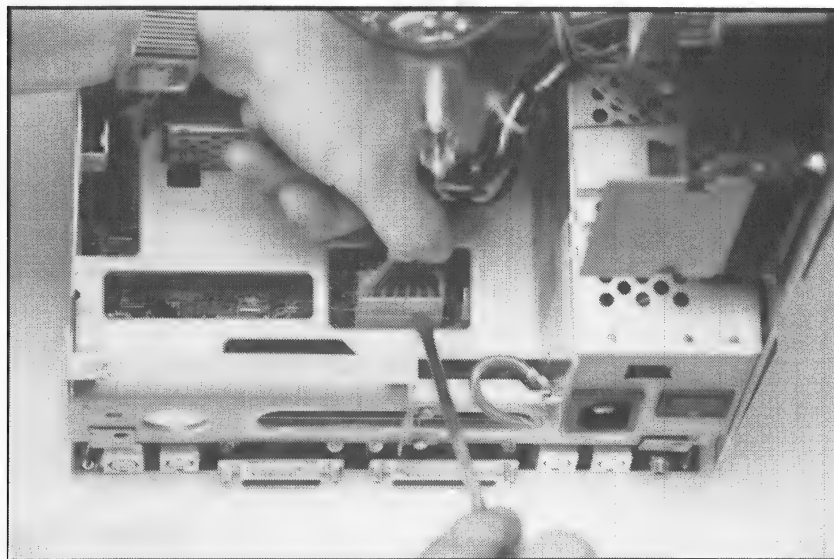

Figure 4-4   Main power cable

☐ 7. Pull the main logic board out from the chassis.

Preparing the main logic board

> **NOTE**   Early models of Macintosh 512K used a ceramic CPU chip; it is very difficult to install the Gemini Ultra successfully onto a ceramic chip (identified by its gray color and chalky texture). The thin package prevents the Killy clip from gripping the chip firmly. A soldered pin modification is required for logic boards with the ceramic chip.

> **NOTE**   Some main logic boards have plastic spacers at either end of the CPU. If present, remove the spacers by gently prying them off.

☛ To mount your Gemini Ultra onto the main logic board with a Killy clip, use the following instructions. For more information, please review the **Introduction** of this manual.

> **NOTE**   Please be sure to read this entire section prior to installing the Killy clip, as it is the most important part of the installation.

☐ 1.   Using appropriate static precautions, prop the main logic board against a stable vertical surface. Clean the CPU by applying isopropyl alcohol to the CPU pins and removing any foreign particles with a clean, soft-bristle toothbrush. Wait until the main logic board is dry before proceeding.

☐ 2.   Before installing the clip, check for any of the inner spring contacts protruding toward the inside of the clip. Gently press any "outstanding" pins back with the broad face of a flat blade screwdriver. These pins can get caught during seating and become bent.

☐ 3. At both ends of the Killy clip there is an internal catch that locks under the end of the CPU. Hold one end of the Killy clip against an end of the CPU, applying thumb pressure to keep the catch compressed against the chip.
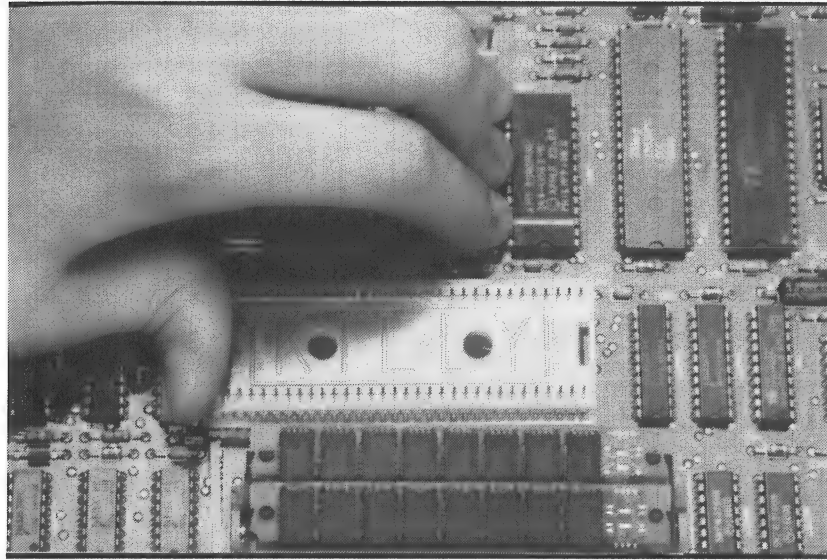

Figure 4-5 Press and hold Killy clip against CPU

☐ 4. Maintaining thumb pressure, use the tip of a medium, flat-blade screwdriver to pry out the catch at the opposite end, and lower the clip into place over the CPU. When everything is aligned, press down **hard** and evenly on both ends of the clip until it **snaps down** firmly onto the CPU.
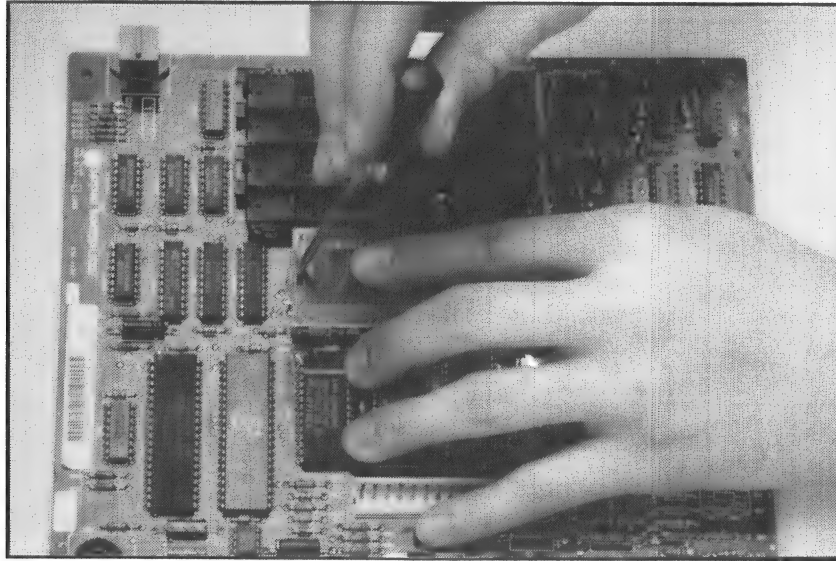
Figure 4-6   Seating the Killy clip

☐ 5. Look through the sides of the Killy clip to ensure all contacts are in place.

☞ If any pins are visibly bent, you'll need to remove the clip.

Insert a small screwdriver through the right-hand top slot, so you can first pry the plastic catch **outward.** With a second screwdriver, pry the base of the clip **upward—but take care** not to damage the surface of the main logic board. The right end of the clip will now come free. Before lifting it completely off the CPU, use a screwdriver in the left-hand top slot to free the plastic catch at that end too. Straighten any damaged pins, and remount the Killy clip—the pins are fairly resilient and can *usually* be reformed to their original shape.

☐ 6. With the Killy clip mounted to the CPU, confirm it is fully seated and *flush* with the main logic board. Work around the perimeters of the clip with the screwdriver tip, pressing down **hard** to ensure all contacts are fully seated.
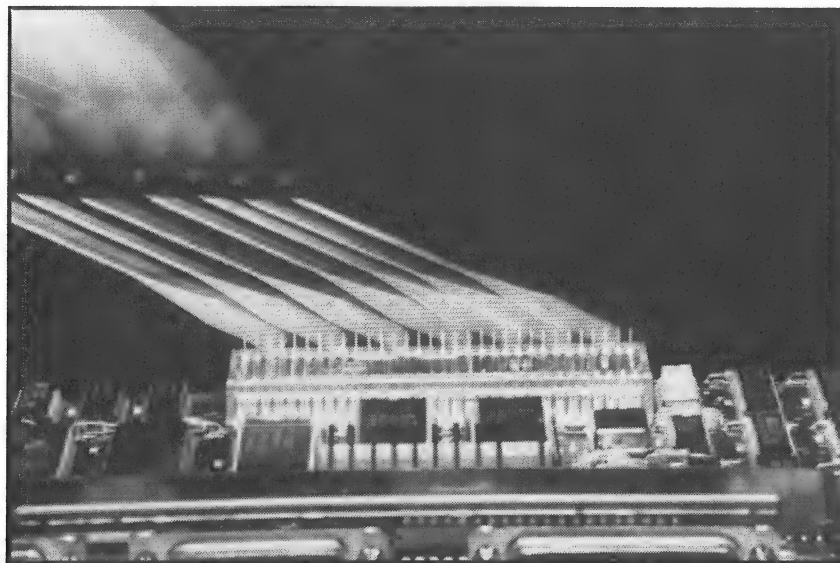
Figure 4-7   Working around the perimeters of the clip

☐ 7. Now you'll mount the 64-pin socket onthe Killy clip. Starting on the right side, line up the socket over the clip pins. Working from right to left, gently press the socket down **a little at a time** onto the Killy clip pins with the tip of a flat-blade screwdriver.

☐ 8. When the socket is fully seated, check to make sure that none of its pins are bent.

☛ If you wish to use the **solder-pin modification method** to mount your accelerator card onto the main logic board, use the following instructions. For more information, please review the **Introduction** of this manual. Remember, a factory-authorized installation is **highly recommended.**

☐ 1. Clean the connectors of the CPU, first with a hard pencil eraser, then with isopropyl alcohol and a toothbrush.

☐ 2. Wait until the alcohol has completely evaporated before proceeding.

☐ 3. Using the 64-pin socket as an alignment jig, mount a 32-pin header pin into each side of the socket.

☐ 4. Now mount the header pin/socket combination over the CPU. Solder the four corner pins first.

> **NOTE** The lower ends of the header pins *must* rest 1/16" to 1/32" *above* the main logic board. If they sit flush with the main logic board, there will be clearance problems between the main logic board SIMMs and the underside of the accelerator card. If they sit too high, there will be clearance problems between the accelerator's SIMMs and the underside of the chassis.

> **NOTE** Solder the header pins, *not* the 64-pin socket, to the CPU legs!

☐ 5. Finally, solder the other 60 header pins carefully to the legs of the CPU. Take *great care* not to overheat your work!

Attaching the VIS clips

Video Installation ONLY

The VIS cable brings several signals to the adapter card from the main logic board. It has a positive-locking connector at one end, and three spring-loaded clips at the other.

> **NOTE** The spring-clips are a little tricky to position; they tend to stand up, but they need to lie as flat as possible. They are also rather easily dislodged during assembly, or if the Macintosh is bounced around during transportation. It's often helpful to "tack" the tips in place with a dab of solder—but this is not a required installation step.

> **NOTE** You'll need to connect the clips *before* you mate the accelerator card to the main logic board.

Black VIS clip

☐ 1. The **black** VIS clip supplies a 16MHz clock signal. Connect it to pin 2 of the 74xx04 chip located next to the high ROM on the main logic board. See diagram for the location of the 74xx04 chip.
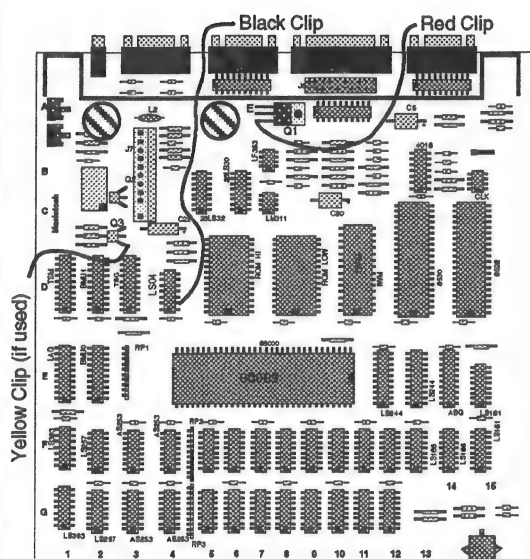

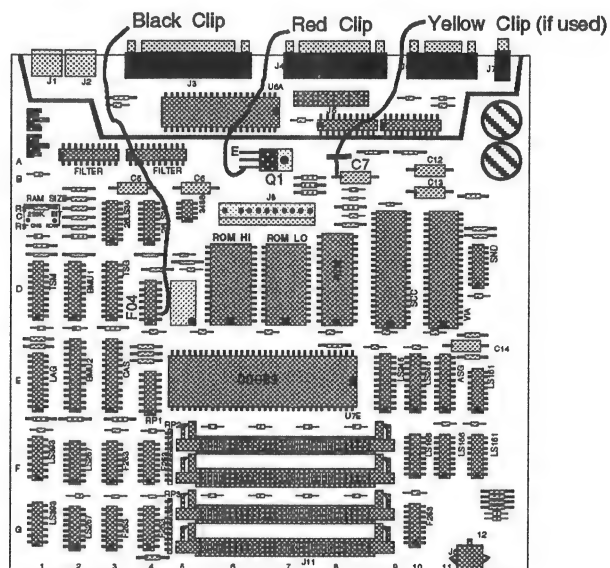
Figure 4-11   Macintosh 512K Main Logic Board

Figure 4-12   Macintosh Plus Main Logic Board

Red VIS clip

☐ 2. The **red** VIS clip provides a -5 V supply. Connect it to pin 3 of component Q1 on the main logic board. See figures for the location of Q1.

It is very important to connect to the correct leg of Q1. Study the diagram carefully!

Warning!

Yellow VIS clip

☐ 3.   The yellow VIS clip provides a +12 V supply for voltage regulator VR2. VR2 is near one end of the main connector, in the corner of the video card; it's distinguished by three pins soldered to the PC board, and has a metal tab protruding from its square plastic body opposite the three pins. If VR2 is installed, connect the yellow VIS clip.

> **NOTE**   All Galileo video cards shipped *after May 1, 1991* include the regulator — if your video card predates this addition, you'll see only a white rectangular outline on the circuit board marked "VR2"; if so, the yellow VIS clip is *not* needed, so cut or tape it back to prevent accidental contact with other components.

Mounting the Gemini Ultra onto the main logic board

☐ 1.   Position the Gemini Ultra with P4, the 64-pin expansion connector, pointing at the rear of the main logic board (the rear edge contains the back-panel connectors).

☐ 2.   Put an ordinary business card on top of the main logic board SIMMs, so they won't short to the underside of the accelerator card.

☐ 3.   Carefully align the 64-pin socket mounted on the bottom of the card to the 64-pin spacer socket mounted to the Killy clip or solder-pin modification on the main logic board.

☐ 4.   Before proceeding, inspect the alignment of the Gemini Ultra and the main logic board along each side. Ensure the pins are correctly lined up with the socket on the underside of the card.

☐ 5. Gently push down on the accelerator card until it is seated on the main logic board, with the boards parallel at all times. Do NOT press down on the SIMMs!

NOTE   The best place to press is near the center of the Gemini Ultra, where there's an outline of the 64-pin socket

---

Installing GemFan/GemPower

☐ 1. *Before* you fasten the fan bracket to the chassis, you must attach the adapter card to the rear of the bracket. If you already fixed the bracket to the chassis without the adapter card, you'll have to remove it. It's easiest if you disconnect the connectors at the top of the auxiliary power unit.

☐ 2. Use the aluminum spacers and screws supplied with the video expansion kit to attach the adapter card to the rear of the auxiliary power supply bracket. Be **sure** to include the insulated rubber washers between the threaded barrel spacers and the adapter card.
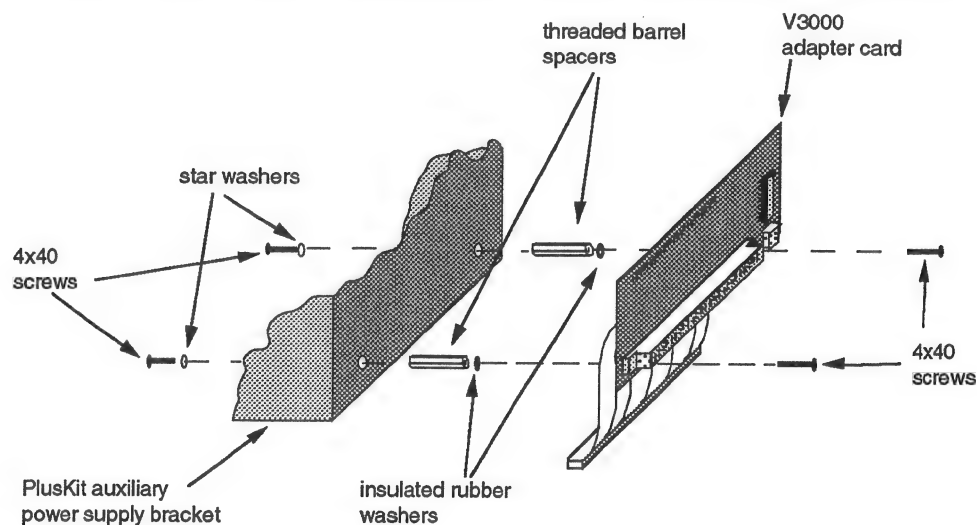
Figure 4-13   Adapter card assembly

Preparing the chassis

☐ 1. It is VERY important to tape two projecting edges on the underside of the chassis to prevent them shorting against the SIMMs on the accelerator card. It is also a good idea to remove the screw indicated in the diagram; the clearance is not always critical, but it's better not to take the chance.

☐ 2. Tape the sharp edges of the triangular slot in the chassis where the 64-pin ribbon cable is routed, to prevent damage to the insulation and consequent shorting. Then route the ribbon cable downwards through the triangular slot. The cable is pre-cut to compress and fold easily as it passes through the slot.

Warning!

Use electrician's insulation tape, not common duct tape. Tape only the indicated areas; if you go overboard with the tape, you will impede cooling, which will drastically shorten the lifetime of your Macintosh and accelerator card!

remove screw
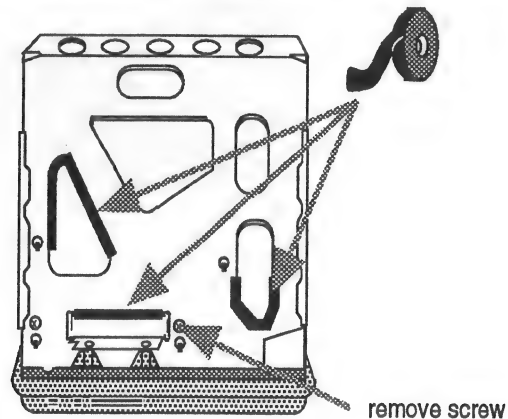
Figure 4-14   Taping the sharp edges

☐ 3. Lay the Macintosh with its screen face down on your work surface with the bottom of the machine facing you.

☐ 4. The photo below shows the four screw holes required to attach the GemFan/GemPower bracket. You'll need to remove existing screws in the upper pair of holes; the lower pair may already be vacant.
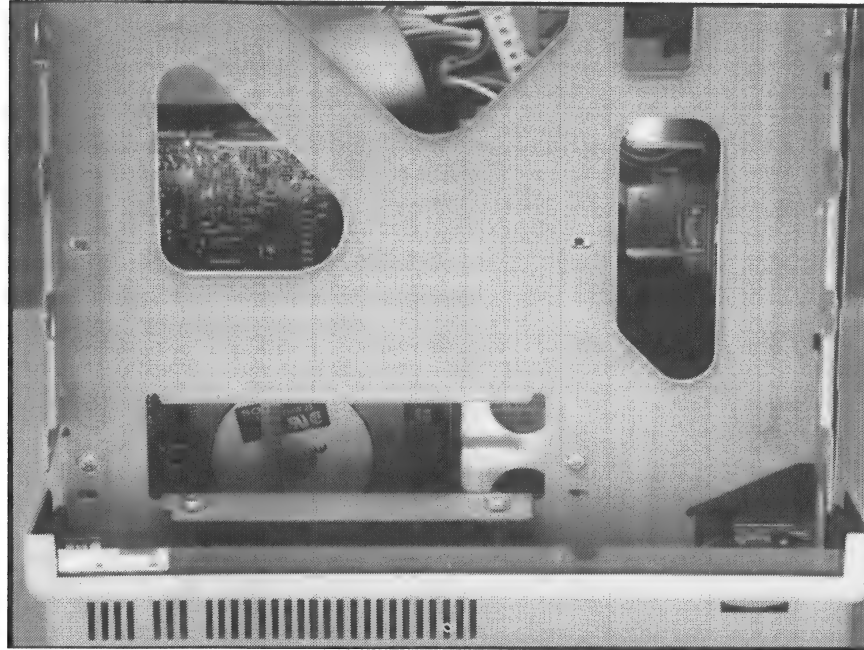
Figure 4-15   Four screwholes used to attach GemFan/GemPower bracket

☐ 5. Working from inside the machine, mount the bracket so its threaded studs fit through the screwholes shown on the previous page. Route the floppy drive ribbon cable through to the underside of Macintosh. The four studs that connect the fan bracket to the inside of Macintosh are not uniform — the top right stud must be shorter to clear the Gemini Ultra.

☐ 6. Secure the fan bracket to the Macintosh with a large washer, a small washer, and a nut on each of the three long studs; and tighten with a 3/16" nut driver. **On the shorter stud**, apply **only** the nut (not the washers) and tighten with the nut driver. Paint a layer of nail polish over the nut, or use thread lock compound to glue it in place.

Do not overtighten the nuts—the threaded metal studs will break off.

Warning!
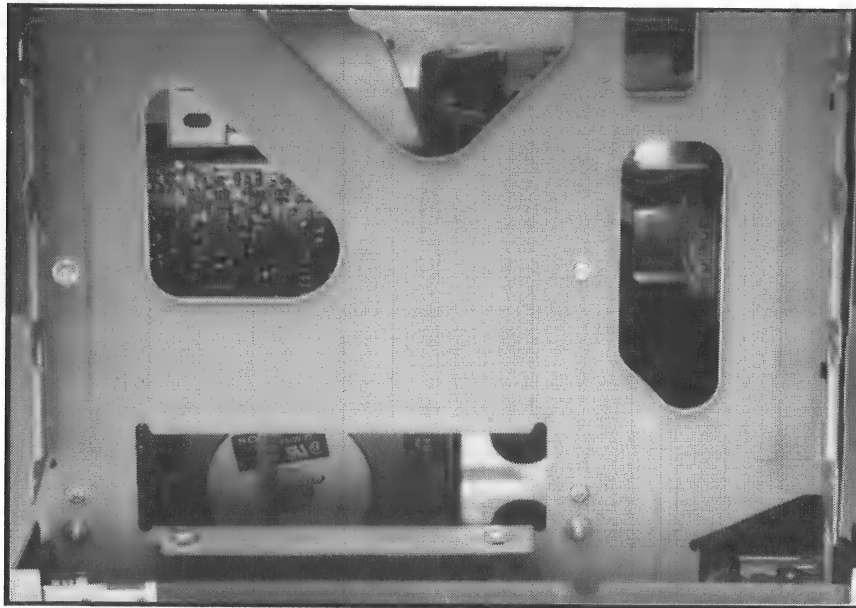
Figure 4-16   Bracket attached; note upper right stud uses no washer

Connecting GemFan/GemPower input clips

☛ **US-model (120VAC)** analog board

☐ 1. Locate the triangle with the lightning bolt symbol inside, located three inches below the power switch on the Macintosh analog board.
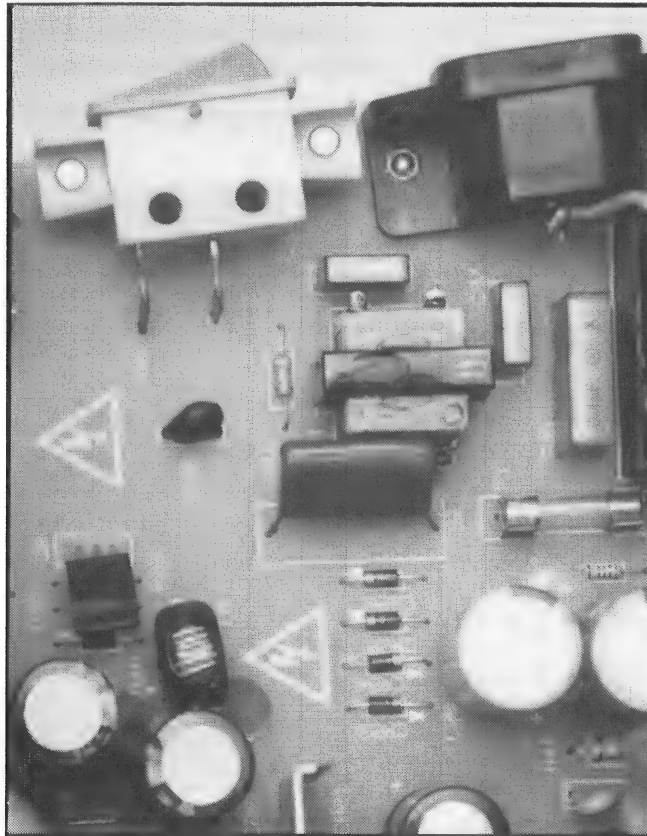
Figure 4-17 Lightning bolt symbol on Macintosh US-model analog board

☐ 2. Locate diodes CR23, CR24, CR25, and CR26, directly to the right of this symbol.

☐ 3. Connect a **brown-** or **blue-wired** clip from GemPower to the LEFT side of **CR25**.

☐ 4. Connect a **brown-** or **blue-wired** clip from GemPower to the LEFT side of **CR26**.

☐ 5. Connect a **black-** or **red-wired** clip from the GemFan to the LEFT side of **CR23**.

☐ 6. Connect a **black-** or **red-wired** clip from the GemFan to the LEFT side of **CR24**.

☞ **International-model (220VAC)** analog board (same orientation as Fig 4-27)

☐ 1. Locate transistor Q8 and resistor R37 (about 4cm above the speaker), and diodes CR24 and CR25 (about 6cm in front of the power switch)

☐ 2. Connect the **brown-wired** clip from GemPower to the UPPER end of **CR24**.

☐ 3. Connect the **blue-wired** clip from GemPower to the UPPER end of **CR25** .

☐ 4 Connect the **red** clip from the GemFan to the metal tab of **Q8**.

☐ 5. Connect the **black** clip from the GemFan to the RIGHT end of **R37**.

Make sure the four clips from GemFan/GemPower are connected to the correct diodes. Incorrect connections will damage your Macintosh.

Warning!

Connecting the accelerator card

☐ 1. Connect one of the two auxiliary power cables to the 4-pin connector at the left rear of the accelerator card. The cables are interchangeable—one supplies the accelerator card, the other feeds the video adapter card, if installed. They end with brown, plastic one-way connectors — make sure the connector is oriented correctly.

☐ 2. If you are **not** installing an external display, tie the remaining cable back out of the way. Don't cut the spare cable off; if you decide to add an external display later, you'll need it.

☐ 3. Attach the lower end of the high-speed SCSI interface cable to the SCSI slot at the front corner of the accelerator card. The slot is keyed for correct connection.

Warning!

Use only a high-speed SCSI interface cable supplied for a Gemini Ultra card. The body of the battery door connector is BLACK. Do NOT use a SCSI cable with a BLUE connector body, designed for use with an earlier Gemini accelerator—damage to the Gemini Ultra card or to a SCSI device will occur.
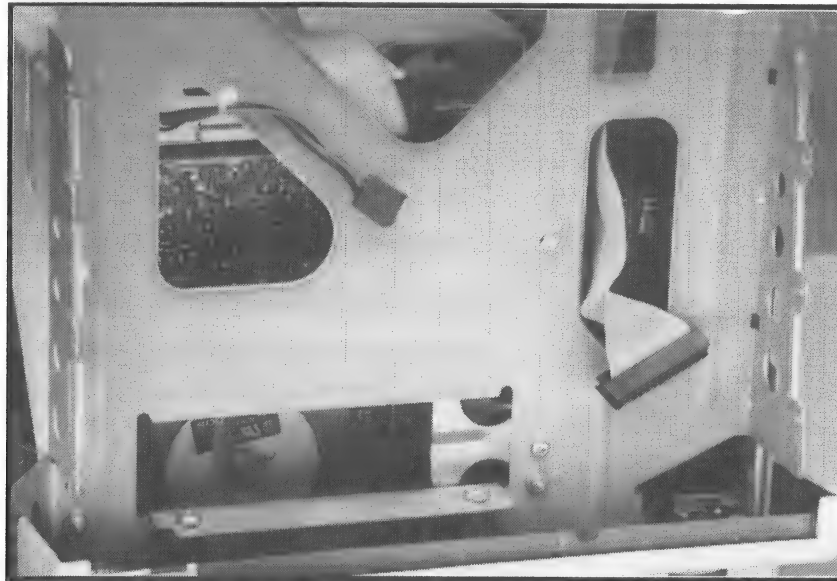
Figure 4-18 Auxiliary power cable and high-speed SCSI interface cable

Video Installation ONLY

☐ 4. Lead the free end of the VIS cable up through the same triangular chassis slot and plug it into the 3-pin connector at the lower right-hand edge of the adapter card. It is a brown, plastic one-way connector — make sure it's oriented correctly.

☐ 5. Connect the remaining auxiliary power cable to the 4-pin connector on the adapter card. The plug is keyed for correct connection.

Up to this point, you could conduct each step with the main logic board at a distance of up to 3.25" (6 cm) from the chassis rails. Now you'll need to bring the main logic board and accelerator card assembly closer to the chassis, where you will eventually insert it between the rails.

☐ 6. Connect the 64-pin ribbon cable from the adapter card to the accelerator's expansion port, P4. This is often a tight fit; make sure you have lined up the connectors correctly, then press firmly and with patience. Be sure to **support the accelerator card** from its opposite edge with your free hand as you apply pressure, so that the connection between the accelerator card and main logic board is not put under excessive lateral stress.

NOTE   The connector is keyed for correct orientation.

V3000 adapter card   main logic board

PlusKit fan bracket

connector P4

accelerator card

(support with other hand)
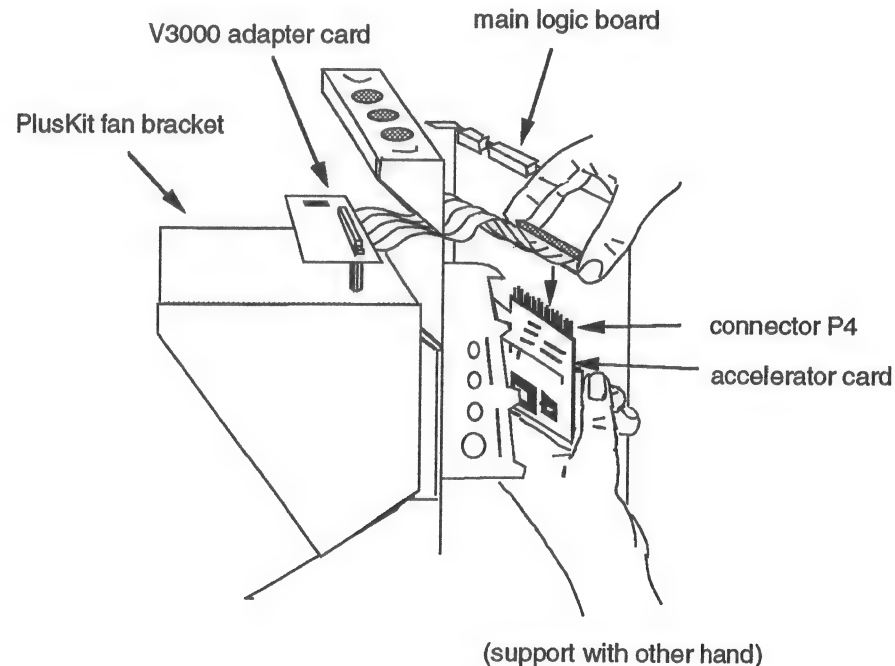
Figure 4-19   Connecting adapter card to accelerator expansion port P4

Video Installation ONLY

> **NOTE** Make sure the connector seats fully; this step is frequently the culprit if your external display system doesn't work after you've completed installation.

> **NOTE** If you need to remove the connector at a later time, take care to keep it square to the expansion port's pins, otherwise you may bend them as you pull the connector off. It's easiest to first loosen the ends by prying them up gently about 4-6mm (1/4") with a flat-blade screwdriver

☐ 7. While moving the assembled accelerator and logic board closer to the chassis for installation, carefully pull up any slack in the 64-pin ribbon cable through the slot in the chassis. Compress the cable slightly to avoid abrading its edges against the sides of the slot.

Installing the accelerator card and main logic board assembly

☐ 1. Prepare to reinsert the accelerator and logic board assembly into the chassis.

> **NOTE** Don't try to just slide the whole assembly back along the chassis rails; it won't fit.

☐ 2. Position the main logic board parallel to the frame rails.

☐ 3. Reconnect the main power cable to the logic board.

☐ 4. Place the left edge of the main logic board inside the metal guide rails, and swing the board, like you are closing a door, toward the right side guide rails.

☐ 5. Insert the right edge, using the flat-blade screwdriver to force the rail outwards slightly. This lets you work the right edge of the main logic board carefully into the chassis.

☐ 6. Carefully spread the metal guide frame on the right side, where the main logic board is not yet inserted, by inserting a medium flat blade screwdriver between the main logic board and the frame until the main logic board is popped into place.
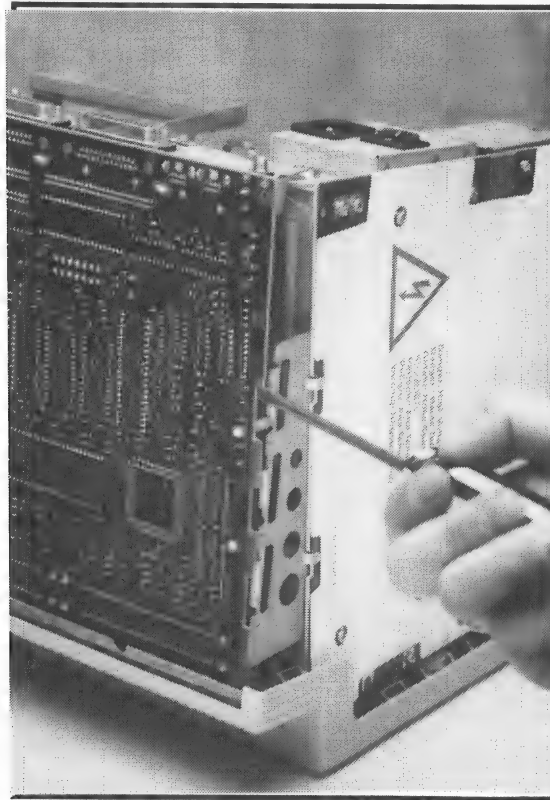
Figure 4-20 "Popping" main logic board into chassis

☐ 7. With the main logic board successfully mounted inside the chassis guide rails, lower it into position by the remaining 1/2″ (13mm), until fully seated.
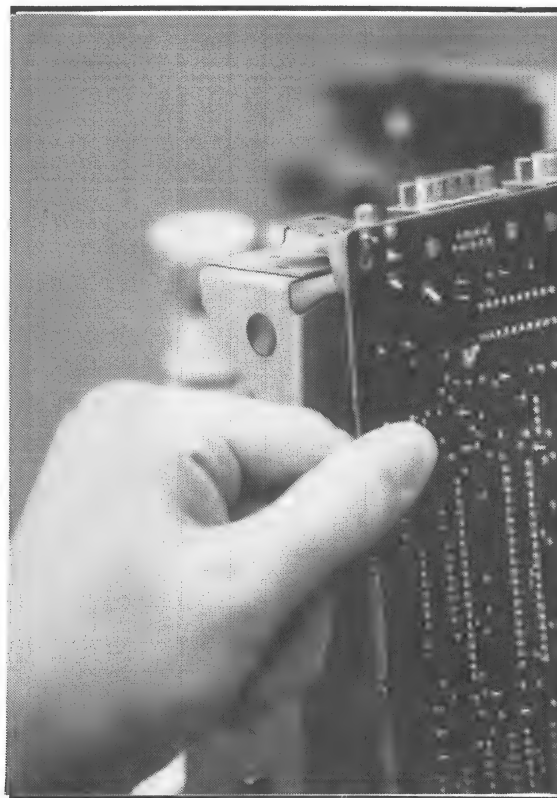
Figure 4-21   Seating main logic board into chassis

> **NOTE**   Once the whole assembly has been installed as described above, it *cannot* be removed by sliding it out on the guide rails—it can *only* be removed by reversing the above procedure.

☐ 8. Reconnect the internal floppy drive and main power cables to the main logic board.

☐ 9. Replace the foil RFI shield, making sure it fits correctly around the ports at the rear of the main logic board.

Adding the video card

☐ 1. Carefully test-fit, then permanently attach, adhesive-backed Velcro™ to the rear of the CRT driver card, and to the corresponding point on the rear of the video card when plugged into the P2 connector on the adapter card. This prevents the upper end of the video card from rattling against the rear of the CRT.
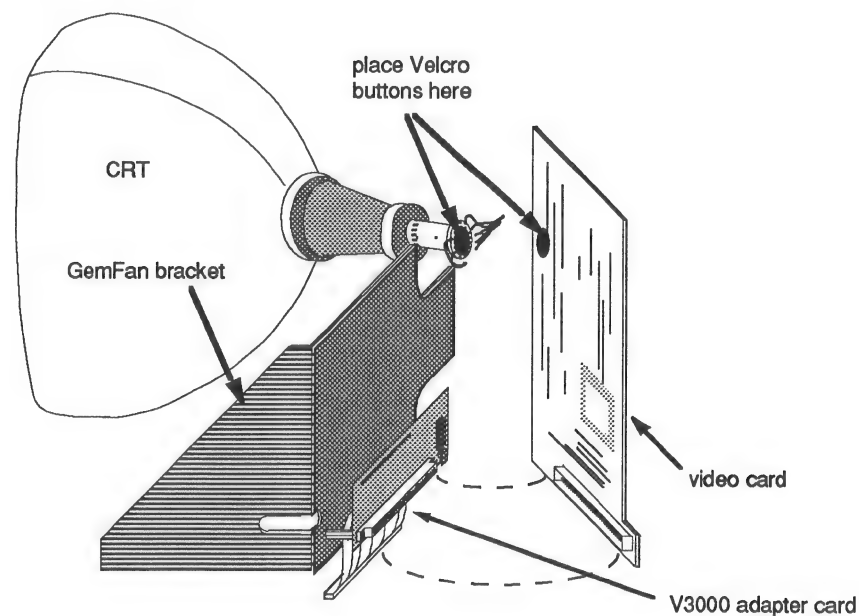
Figure 4-22 Test fit video card to adapter card

☐ 2. Plug the video card into the adapter socket and secure the Velcro buttons.

Pre-Testing the Installation

Save time by pre-testing your work *before* putting the case back on and tightening the screws. Read the following steps before proceeding.

WARNING
Without the case, when power is applied, the ONLY shield protecting you from very high-voltage hazards is your COMMON SENSE!
Take GREAT CARE not to touch the CRT, the flyback transformer, or other exposed metal parts. Touch ONLY the power switch itself or the plastic front bezel.

☐ 1. Turn the Macintosh onto its face. Drape the high-speed SCSI connector out of harm's way over the fan bracket. Make sure the computer is well clear of other obstructions, tools, etc.

☐ 2. Plug in the power cable. Turn on the Macintosh.

☞ If the Macintosh makes a **very short** "boing", a **prolonged** "boing" (or a **distorted** "squawk"):

1. IMMEDIATELY TURN OFF the power!

2. Remove the power cable BEFORE you proceed!

Probability: 45%	*Confirm that the SIMMs on the accelerator are not shorting to the chassis, and that the SIMMs on the main logic board are not shorting to the underside of the accelerator.*
Probability: 34%	*Power problem; the accelerator isn't getting power. Recheck connections to the analog board—are the clips connected to the correct side of their respective diodes? Check the auxiliary power supply output lead is plugged into the accelerator.*
Probability: 20%	*Problem in the connection between the accelerator and the main logic board; check the Killy clip or solder mounting closely. Inspect the spacer socket pins.*

3. Turn to the Troubleshooting section of Chapter 6 for more clues. Repeat the pre-test before you complete installation.

☞ If the Macintosh makes **no** "boing":

1. IMMEDIATELY TURN OFF the power!

2. Remove the power cable BEFORE you proceed!

Probability: 30%	*As long as the power cable is providing power (is the far end still plugged in?) there is an open circuit or short circuit. Confirm that the SIMMs on the accelerator are not shorting to the chassis, and that the SIMMs on the main logic board are not shorting to the underside of the accelerator.*

Probability: 60%	*Usually a problem in the connection between the accelerator and the main logic board; check the Killy clip or solder mounting closely, and inspect the spacer socket pins.*

3. Turn to the Troubleshooting section of Chapter 6 for more clues. Repeat the pre-test before you complete installation.

☛ If the Macintosh makes a **normal** "boing":

☐ 1. Tilt the Macintosh back at a 45-degree angle, pivoting it on the lower front edge of the chassis, so you can see the screen. Support it from the front fascia. Be certain you do NOT touch any live parts! (You'll know it if you do)

☐ 2. Inspect the display.

☛ If the display turns to a grey pattern, pauses, then shows a **flashing question mark** over a disk icon:

☐ Normal. Sit the Macintosh on the pink anti-static foam pad to protect the bottom of the main logic board. Adjust the voltage at pin 6 of the external floppy drive port to +5V, using the voltage adjuster on the analog board and a DC volt meter.

☐ Turn off the power, unplug the main power cable, and proceed with installation.

☛ If the display shows a regular **pattern of black and white bars** (vertical or horizontal):

Probability: 99%	*Problem in the connection between the accelerator and the main logic board; check the Killy clip or solder mounting closely. Inspect the spacer socket pins.*

☛ If the screen **stays black**, or there is **some other display:**

Probability: 70%	*Power problem; the accelerator is not getting power. Recheck connections to the analog board—are the clips connected to the correct side of their respective diodes? Check the auxiliary power supply output lead is plugged into the accelerator.*

| Probability: 29% | Problem in the connection between the accelerator and the main logic board; check the Killy clip or solder mounting closely. Inspect the spacer socket pins. |

3. Turn to the Troubleshooting section of Chapter 6 for more clues. Repeat the pre-test before you complete installation.

Security Port output connector

☐ 3. Push the body of the security port output connector home into the security port on the rear case half of the Macintosh, making sure that the connector's pins point towards the power switch.
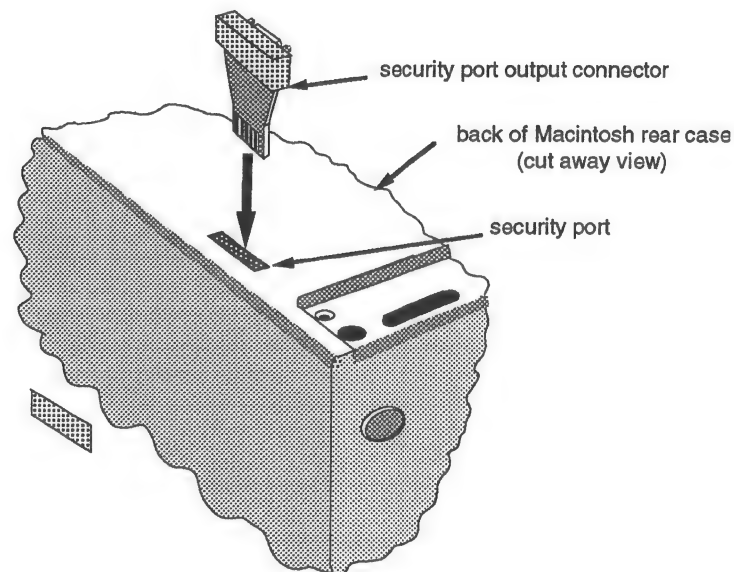
Figure 4-23   Connecting the security port output connector

Video Installation
ONLY

Battery door connector

The battery door connector replaces the original Macintosh battery door, and is secured with the same case screw. Trim material from the battery door opening, so the ribbon cable fits easily between the battery holder (built into the analog board), and the opening for the battery door in the rear case half.
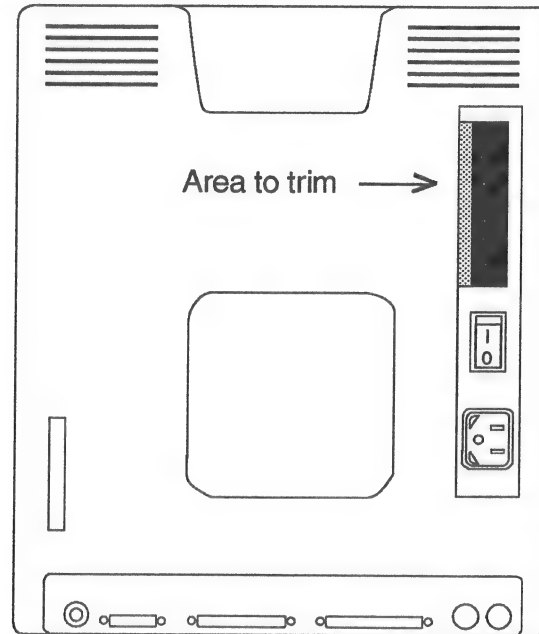
Figure 4-24   Battery door opening

☐ 1. Cut back the raised edge of the battery door opening in the rear case half. Remove enough material from the inside edge of the case (shaded area in Figure 4-24) to accommodate the width of the ribbon cable easily, and center the battery door.

☐ 2. When you think you have removed enough material, test-fit the rear case half onto the Macintosh to ensure that the cable won't be pinched by inadequate clearance.

Connecting the video card to the output port

☐ 1. Turn the rear case so that the inside cavity is accessible. Attach the slotted edge connector of the *internal* video cable to the edge of the security port output card inside the rear Mac case. Bring the rear case half up close to the Macintosh.

Dual-Page Display

J5-ECL1

J2-VIDEO OUT
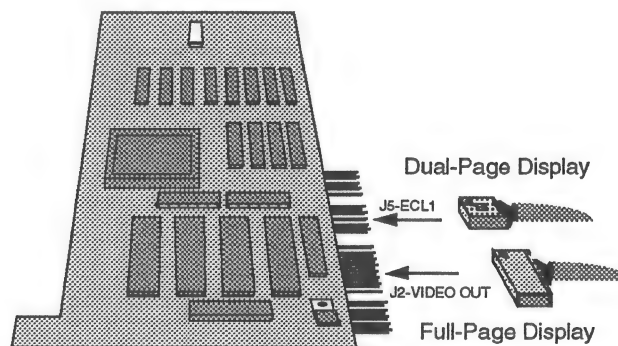
Full-Page Display

Figure 4-25   Connecting video output adapter and DB-9 cable to the video card

☐ 2. Attach the connector at the free end of the internal video cable to the appropriate pins on the Galileo video card, as shown.

- Full-page display cables plug into the 15-pin connection marked "J2 VIDEO OUT."

- Dual-page display cables plug into the 10-pin connection marked "J5-ECL-1."

- Pin 1 on the plug bodies is marked with a **triangle** on the **upper** surface—put that end of the connector next to Pin 1 (you'll find the pin numbers are labelled on the video card connector.)

☐ 3. Route the high-speed SCSI interface connector out through the battery door opening. Slide the rear case half back onto the Macintosh.

☐ 4. Make sure that the case halves slide together smoothly. If you encounter resistance, verify that the video port cable is not trapped between the case halves — **do not** just force them together. You may also find that the analog board is misaligned—just wiggle it back into place!

☐ 5. Tuck the battery door high-speed SCSI connector back into the battery door opening and fasten the case screws. The new connector replaces the battery door, attaching with the case screw that was originally behind the battery door. As you secure the screw, tighten it only enough to hold it in place, or the threads will strip.

Completing installation

☐ 1. Reinstall the programmer's switch.

☐ 2. Attach the "Service Note" decal to the rear of case and the "*TOTAL SYSTEMS*" decal to the front.

☐ 3. Connect the external display to the security port output connector. Connect power to the Macintosh and external display. Turn on the external display.

☐ 4. That's all — you're done with the hardware installation! Congratulations!

☐ 5. Start up the Macintosh, and use the **Software Installation** section to install and configure the Control Panel software.

NOTE   Don't forget to send in your Warranty Registration card!

Installing GemStart

NOTE   System version 6.0.7 or later is required to use the Gemini Ultra and
        GemStart software. If you have an earlier version of the System
        installed on your hard disk, you should upgrade using the Installer
        application. Please check the READ ME file for any additional
        software changes.

☐ 1.   Lock the GemStart disk by sliding the write-protect tab so that the hole underneath the
        tab is visible, then make a working copy of the original GemStart disk. Store the original
        disk in a safe place.

☐ 2.   If you are using System 6.0.7, place GemStart in the **System** folder on your hard disk. If
        you are using System 7.0, GemStart should be placed in the **Extensions** folder and an
        alias of GemStart should be placed in the **Control Panels** folder.

Configuring the Gemini Ultra with GemStart

The GemStart utility software supplied with the Gemini Ultra allows you to set several
options for your accelerator card. The options available vary according to the configuration of
your Gemini Ultra—any options which are not available will be dimmed (greyed out). To
configure your Gemini Ultra, do the following:

☐ 1.   Open the GemStart Control Panel.

☐ 2.   Click the controls to turn the GemStart options on or off.

Use FPU for SANE

With a 68882 math coprocessor installed on your Gemini Ultra, you may use this option to force calculations which use Standard Apple Numerics Environment routines to be executed by the math coprocessor, rather than by the 68030.

The software SANE routines are marginally more accurate than the calculations performed by the math coprocessor. If you need this additional accuracy, you should turn this option off.

This option takes effect immediately.

Instruction Cache

Selecting this option turns on the instruction cache on your 68030 processor. Some software may not be compatible using the instruction cache, particularly copy-protected software. You may wish to turn it off at times when you wish to run software that has this problem. Otherwise, you should leave this option selected for best performance.

This option takes effect immediately.

Data Cache

Use this option to turn on the data cache on your 68030 processor.

Some software may not be compatible with the use of the data cache, particularly copy-protected software. You may wish to turn it off at times when you wish to run software that has this problem. Otherwise, you should leave this option selected for best performance.

This option takes effect immediately.

Start-up Animation

Selecting this option will cause the GemStart animation to be displayed on startup.

Getting help with GemStart

GemStart supports Balloon Help with System 7. Choose Show Balloons to see descriptions of GemStart features as you point at them.

System 7.0.1

The version of System 7 recommended by Apple Computer, Inc., and by TOTAL SYSTEMS is version 7.0. System 7.0.1 is not recommended.

Using Gemini Ultra

Performance Strategies

There are many ways to boost the productivity of your accelerated Macintosh even further, by fine-tuning the computer's environment. Here is a brief smattering of insider's tips.

Using the Disk Cache

With System 6, this is confusingly named "RAM Cache", and is controlled via the General Control Panel.
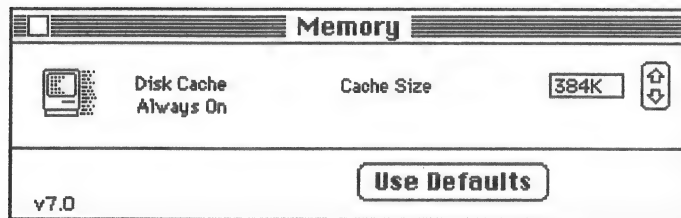
Figure 6-1   System 7 — Memory Control Panel
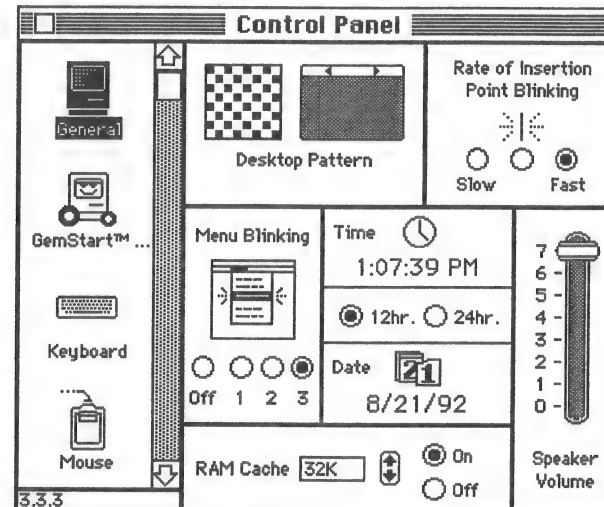
System 6 — General Control Panel

Under System 7, the Memory Control Panel has a minimum setting of 16K. This is barely enough to be useful, but if memory is short, it doesn't consume enough RAM to matter.

Generally, you'll get optimum results by increasing disk cache to between 128K and 384K. Larger amounts **may cause crashes**, particularly with Virtual installed, and are subject to the rule of diminishing returns. (If you use a Macintosh Plus with version 2 ROMs, any allocation beyond 128K is ignored). A 3MB disk cache is Not A Good Idea.

Using the RAM Disk

Many computer users are nervous about RAM disks. The RAM disk feature in VIRTUAL 3.0, supported by your Gemini Ultra, is very reliable. RAM disks are *extremely* FAST.

- **If your System Folder is small,** load it onto the RAM disk at startup, and run from there. The Mac will fly, and restarts will take a tiny fraction of the usual time!

- **Font users:** copy those bitmapped and PostScript® typefaces onto the RAM disk, and use Suitcase™ or MasterJuggler™ to access them from there. ATM™ will redraw faster, and font downloads will zip across as fast as your network and printer can handle.

- **UserLand Frontier™ users:** as long as you back it up often, run Frontier's Root file from the RAM disk. Frontier gets so fast, it's positively *snappy.*

- **HyperCard® users:** you'll see a major improvement by copying HyperCard, the Home stack, and other resource stacks, up to the RAM disk. Remember to save changes to these stacks periodically to your hard drive.

- **Temporary files:** many high-end applications, Adobe PhotoShop™ for instance, specify a drive for writing and reading temporary files, which store large amounts of information "behind the scenes" as you work. If the RAM disk is large enough, it's the optimal place for these short-lived files.

- **If you develop software,** especially with 4thDIMENSION®, HyperCard, Prograph™, THINK C™, etc., copy some or all of your development system, compiler, and support files to the RAM disk for *phenomenal improvements* in compile/edit/debug cycle times.

RAM disk caveats

If there's a power cut, you **will lose** anything you didn't save to a hard drive or other permanent storage. Ordinarily, the RAM disk is saved to a folder on your hard drive when you shut down, and reloaded when you start up again. It *usually* survives even the nastiest System bombs.

The biggest RAM disk hassle is when there's not enough space. Initially, size is determined by the amount of memory on the main logic board (minus a little overhead).

- If your main logic board contains 512K, 1MB, 2MB, or 2.5MB, consider increasing to the 4MB maximum — 1MB SIMMs are cheap these days.

- If your Gemini Ultra uses 4MB SIMMs, for a total of 16MB, drag the scroll bar in the VIRTUAL Control Panel to the left. Every megabyte you adjust is deducted from the memory available for application programs, but is added to the RAM disk capacity, after restarting. By restricting yourself to "only" 12MB of memory for running applications, you can use an 8MB RAM disk.

The documentation that accompanies VIRTUAL describes the subtleties of RAM disk use, with a detailed treatment of memory topics in general. It's well worth your time to read it.

VIRTUAL's Move I/O Feature

The Connectix documentation may leave you feeling that the conservative approach is to turn off the Move I/O feature of VIRTUAL; in fact, machines generally behave significantly better *with* Move I/O than without it.

Compatibility & Common Sense

You'll find little or no incompatibility between Gemini Ultra and commercial application software. The basic principle: **Software which complies with current Apple Computer, Inc. programming guidelines will work without problem**. Programs that require Color QuickDraw won't work, though.

Older, or incorrectly-written Macintosh software, *particularly* programs with copy-protection schemes, may cause problems. Contact the original publisher of the application for update information and technical support.

Don't start out by automatically suspecting your accelerator card — it usually *isn't* at fault!

Some customers ask if they can run their Gemini Ultra accelerators without GemStart. It's true that the accelerator doesn't "require" GemStart — the Macintosh runs on the accelerator from power-up onward, unless you explicitly disable it using the technique described later in this chapter.

However, pulling GemStart out of your System Folder if you have problems is **Not a Good Idea** — GemStart replaces considerable amounts of original Apple code that **fails** at accelerated speeds. Follow the troubleshooting steps in Tech Tips instead.

System 7 — Fear vs. Fact

Many of our customers are apprehensive about moving to System 7. Don't be.

System 7 is the most thoroughly tested, most stable, most reliable operating system in the history of Macintosh. Period. Many of our customers find that persistent, difficult-to-pin-down system crashes cease — **after** they move to System 7.

System 7 requires that you have a good disk driver (see below), but you really need a good disk driver anyway. You'll probably have to purge some of your older extensions (INITs and cdevs, in pre-System 7 parlance). If your software library is reasonably current, you're unlikely to experience any application compatibility problems — and the ease-of-use benefits are dramatic.

(At this writing, System 7.0, with the latest version of System 7 Tuneup, is the recommended version for your Gemini Ultra-accelerated Macintosh. **System 7.0.1 is NOT recommended for Macintosh models prior to the Powerbooks, Classic II and Quadras** — either by TOTAL SYSTEMS or by Apple Computer, Inc.)

The reported bug in System 7 which could lead to disappearing folders was *extremely* rare, judging from our customers' feedback. System 7 Tuneup 1.1.1 fixes the problem, so be sure to install it. System 7 Tuneup is available wherever you get your System software.

System 6 — If you really insist...

Make sure that you have enough **free system heap space**. The white portion of the bar graph you'll see after choosing "About the Finder" from the Apple menu shows how much free RAM is available in the System heap. Test this right after restarting the Macintosh.

About the Macintosh® Finder™

| Finder : | 6.1.8 | Larry, John, Steve, and Bruce |
| System : | 6.0.8 | ©Apple Computer, Inc. 1983-90 |

Total Memory : 1,024K

| Finder | 757K |
| System | 267K |

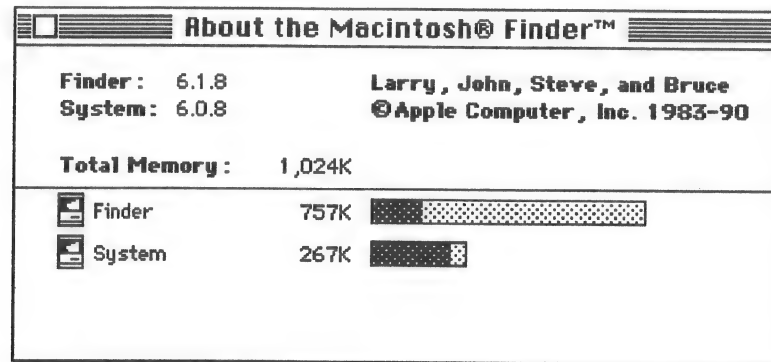*Figure 6-2   System 6: About the Finder dialog — white portion of System bar should be 10-20% of total*

If the System bar is less than 10% white (free), expect crashes as your applications and extensions periodically run out of memory, and die. Various software utilities let you increase the free System heap space; the best choice is upgrading to System 7, which manages the System heap automatically.

Serial Ports

Software which drives the serial ports directly, rather than using Apple's supplied routines, does so at its own risk — it's the programmer's responsibility to "do it right". If code fails to determine the actual execution speed of your system by direct testing, it may wrongly presume that it is running on a stock machine, and use inappropriate timing for serial port communications.

This does **not** happen with commercial communications software. MicroPhone II™, White Knight™, TeleFinder™, CompuServe Information Manager™, America Online™, etc, are all fine. These applications check all pertinent features of the hardware environment before running.

Other serial port software is sometimes problematic, with erratic communications, system bombs or freezes. Check with the publisher if you experience difficulty using non-Apple printer drivers, MIDI systems, etc. Make sure you are using **the latest version**.

To find out if poor coding is the root of difficulties, turn off the Instruction Cache, and/or the Data Cache, in the GemStart Control Panel. This drastically slows down your accelerator, and if the undesired symptoms cease or diminish significantly, it's a strong indication that the software was not robustly designed.

Contact TOTAL SYSTEMS Technical Support if your problems are still not resolved.

LocalTalk

Networking your accelerated Macintosh **requires** GemStart. You won't be able to reach other devices (printers, other Macs, networked modems, etc.) without GemStart. Other devices won't be able to communicate with your Macintosh without GemStart. **That's all there is to it.**

Current versions of GemStart work well with all known PostScript printers, networked modems, fileservers, etc. AppleTalk Phase 2 is supported.

Digitized Sound

Since GemStart 2.0.3, the quality of digitized sound playback on TOTAL SYSTEMS accelerators has been *excellent!* Applications and utilities that use Apple's Sound Manager routines in System 6.0.7 and later will produce clean, crisp sound. Two issues remained problematic until just before this writing.

Some software, for example Farallon's SoundEdit™ package, and the Farallon playback XMCDs for HyperCard, manages sound playback internally. This is fine, if the code is written so that playback is timed correctly on accelerated systems. Unfortunately, it sometimes isn't.

In each case where our customers have drawn our attention to this problem with specific software, we have contacted the publishers to advise them of the steps they can take to remedy their problem. Some have been quick to correct the problem, some have not.

If you are using a current version of an application or utility, and sound playback has glitches or crackles on your Gemini Ultra, call the publisher. Tell them you're a discontented customer of theirs, that you use an award-winning Gemini Ultra accelerator, and that you expect a fix. We will happily help if they need assistance on how to do it right.

The second issue is due to bugs in Apple's Sound Manager routines which can cause system bombs on *any* Macintosh model, accelerated or not. Apple acknowledged some of these at the 1992 Worldwide Developer's Conference, and fixes should appear in future System software Real Soon Now. In the meantime, GemStart 2.4, in final Beta testing at this writing, contains fixes for Apple's goofs immediately.

Games software

Games programmers often stretch or break Apple Computer, Inc. programming guidelines to get maximum speed out of the Macintosh. Many games detect Plus or SE ROMs, and resort to trickery or special features to get necessary speed. Unfortunately, not all of these tricks or features work when an accelerator is installed — as well as being unnecessary!

Flashing screen displays, missing sounds, or application crashes, can often be eliminated by "fooling" the game into assuming it is running on some unknown Macintosh model. Use the **Fool Applications** feature (GemStart 2.4 or later), to "persuade" such programs to check the capabilities of your accelerated Macintosh more closely.

If that doesn't work, disable your Gemini Ultra temporarily. Play the game, then call the publisher to let them know they should do better in future.

Tech Tips — Cutting Through The Mystery

We've put our best strategies for problem-solving into our much-acclaimed Tech Tips. These documents take you by the hand, and help you step-by-step to get your system running at peak efficiency. Tech Tips are written by our Tech Support engineers, and tested by the folks who demand maximum problem-solving effectiveness — our customers. You'll find Tech Tips on current GemStart disks, you can download them over a modem from our Bulletin Board, and they're also available via FAX.

Help! My Mac Keeps Crashing!

If you encounter unusual behavior in an application that worked fine before your Gemini Ultra was installed, or if your accelerator has started acting up out of the blue, follow the troubleshooting strategy detailed in TOTAL SYSTEMS Tech Tip 01 and Tech Tip 03.

- Corrupted or inappropriately installed **System software** is **the leading cause of calls** to TOTAL SYSTEMS Technical Support Team. There are some real subtleties to creating the optimal system software configuration for your accelerated environment. Our Tech Tips are specially written, and extensively tested to help resolve System software problems.

- The next most common problem (about 30% of software-based problems) is corrupted, inappropriately installed, or inferior **disk driver software**. This software controls every aspect of the communication between your computer and your hard drives. It is invisible in daily use — but critically important to the reliability and performance of your Macintosh. All sorts of bad-news symptoms can occur if it is not working properly.

If you are using one or more hard drives with your accelerated Macintosh, and you obtained the drives more than nine months ago, contact the manufacturer of your drive(s) for update information for the disk driver software. If there is an update, GET IT. It is likely to solve the problem, and it will probably make your drive operate more efficiently, too.

Even with the latest driver software from the original manufacturer, some customers continue to have problems. Life is too short to mess around with low-grade driver software. Obtain a disk driver package from one of several third-party companies that specialize in high-quality, high-performance drivers. Although this represents extra expense, peace of mind will be accompanied by better drive performance.

If you have a standard Apple drive, and you have never installed a third-party driver, here's something you should consider. Apple Computer, Inc. makes fine computer hardware. Unfortunately, some of Apple's system software is not so great: when you modify your Macintosh, Apple software often breaks down. Apple HD SC Setup is an example — its *only* virtue is that it is free; it should definitely be replaced!

- After these problem sources, **buggy, conflicting, or poorly-written extension software** most often turns out to be the villain. Again, Tech Tips 01 and 03 will help you to locate the difficulty by process of elimination. **Remember, the more "stuff" you drop into your System Folder, the more "interesting" your life will become... It's your choice!**

Tech Support To The Rescue

AFTER YOU HAVE CAREFULLY WORKED THROUGH Tech Tips 01 and 03, if you're **still** stuck, call Tech Support.

We like to help, and we're good at it! But, please, be patient — our technicians deal with each customer in turn **for as long as it takes**—you *may* have to wait a short while for a callback. We will do our best to get you sorted out as fast as possible. As a last resort in the meantime, restart your Macintosh, and use the instructions below to disable the accelerator temporarily.

Temporarily disabling Gemini Ultra

To disable your Gemini Ultra, you must restart your Macintosh, and you need to have the programmer's switch installed. Consult your Macintosh manual for more information about how to install the switch.

> **NOTE**   If you have a Macintosh 512K, you won't have SCSI access while Gemini Ultra is disabled.

Preparation:

☐ 1.   Choose Shut Down from the Special menu in the Finder. Switch off your Macintosh.

☞   If you have a Macintosh Plus, you must first:

☐   •   Switch off all SCSI devices. Make **sure** the power is off before proceeding to the next step.

Warning!

Connecting or disconnecting SCSI cables while a SCSI device or your Macintosh is still turned on may seriously damage your equipment or your data.

☐   •   Disconnect the SCSI cable from the battery door connector.

☐   •   Reconnect the SCSI cable to the original connector on the back panel of your Macintosh.

☐   •   Turn all SCSI devices back on.

Now take the following steps:

☐ 2. **Hold down** the interrupt button at the rear of the programmer's switch.

☐ 3. Turn on your Macintosh.

☐ 4. Release the interrupt button **immediately after** you hear the "boing" chime finish, as the Macintosh restarts.

☐ 5. If you are successful, the GemStart icon will be "crossed out" at startup, like this:

> **NOTE** If you hold the interrupt button down *too long*, the Macintosh will fail to start, and you will see a "Sad Macintosh" icon on a black screen. If you don't hold it down *long enough*, the Macintosh will restart with your accelerator still enabled. Try again until you succeed: practice makes perfect.

> **NOTE** Macintosh Plus users: with your hard drive formatted at 1:1 interleave for use with Gemini Ultra, your stock SCSI port and Macintosh can easily be overwhelmed during startup with the accelerator disabled. A crash with a flickering Welcome to Macintosh dialog is a typical symptom. Start up from a floppy with System software. You should then be able to access the hard drive; you will probably find that disk operations are very slow.

Re-enabling Gemini Ultra

To use the Gemini Ultra again after temporarily disabling it as described in the previous section, simply **restart your Macintosh.**

> **NOTE** If you have a Macintosh 512K, or Plus, you will first have to reconnect the SCSI cable to the battery door connector.

Troubleshooting

> NOTE Once an accelerator is correctly installed, more than 9 out of 10 problems are software-related, NOT hardware-related.
>
> Be sure to review the beginning of this chapter. Consult all the Tech Tips on your GemStart disk. If you have a modem, log onto the TOTAL SYSTEMS Bulletin Board System for new Tips and product newsflashes.

Installation Problems

If your Macintosh is not fully functional when you first start it up after installing your Gemini accelerator (and Galileo video expansion system, if applicable) — don't panic! You will almost certainly be able to resolve the problem with the help of this manual.

If your Macintosh will at least start up and run briefly, **review the first part of this chapter.** Make sure you have good System software, a good disk driver, and are not suffering a simple extension conflict.

If your Macintosh won't start up at all, or won't run for more than a few minutes, work through this section. If you still have trouble, call TOTAL SYSTEMS Technical Support for further help.

All is not lost if you still cannot complete installation successfully. Contact TOTAL SYSTEMS for referral to a TOTAL SYSTEMS authorized dealer. The cost of professional assistance is minimal, compared with your investment in hardware and the long-term productivity benefits you will experience when everything is running at top speed.

Isolating the problem

Troubleshooting starts from the point at which the Macintosh ceases to behave as expected. The Macintosh goes through this sequence at startup:

After power is applied, the Macintosh makes an initial "Boing" chime. If an external display has been attached and previously turned on, it will change state; *ie* **change from a random greyish pattern to black.**

Exception:	*If there is no "Boing", a distorted "Boing" or a very short or very long "Boing", the accelerator is incorrectly mounted to the main logic board, or there is a short circuit. See **Memory Problems**, **Power Problems**, below.*

Exception:	*If the internal display shows a regular black and white pattern (usually vertical or horizontal bars), the accelerator is incorrectly mounted to the main logic board, the main logic board RAM configuration was changed without correctly adjusting the resistor/jumper settings, or there is a short circuit. See **Memory Problems**, below. If you are using an external display, see **External Display Problems**, below.*

Exception:	*If the external display does not change state, it is not correctly connected to the video card. See **External Display Problems**, below.*

The screen clears to a gray desktop pattern. Memory and other functions are checked by a self-test routine.

Exception:	*If the memory test fails, a Sad Macintosh icon appears, with an error number displayed below. The first non-zero digit is likely to be 1, 2, 3, or 4. See **Memory Problems**, below.*

When self-testing finishes, the Macintosh looks for a drive with valid System software. After checking floppy drives, it searches for SCSI drives. Holding down the mouse button during searching ejects floppy disks, and skips to the next SCSI drive. When a drive containing System software is found, a Happy Macintosh icon appears.

Exception:	*If the floppy drive contains a disk, but no System software is found, a disk icon with a large "X" appears, and the floppy is ejected. Searching resumes.*

Exception:	*If a drive containing System software can't be found, a disk icon with flashing question mark appears. If you have connected a hard drive containing System software to your Macintosh, and this icon appears, the Macintosh has not "seen" the drive. The disk driver may be corrupted (rare) or incorrectly configured, the disk driver is inadequately designed to run with an accelerator (very common), the System software is corrupted (common), or the drive is formatted at 1:3 interleave, rather than 1:1. See **SCSI Problems**, **System Software Problems**, below. Other causes include faulty external SCSI cabling, too-long external SCSI cabling, hard drive mechanism too slow for accelerator (rare), incorrect SCSI termination (common), or faulty driver circuitry (very rare). See **SCSI Problems**, below.*

If a hard drive is located, and communications are successfully established with it, the disk driver is loaded into memory, and takes control of subsequent communications between the Macintosh and the drive. (The floppy driver is available from ROM).

Exception:	*If there is a problem loading or executing the disk driver software, a Sad Macintosh icon appears, with an error number displayed below. The first non-zero digit is likely to be F. See SCSI Problems, below.*

The System file is opened, and selected resources are loaded into memory. The Welcome to Macintosh dialog appears.

Exception:	*If there is a problem loading or executing System resources, a Sad Macintosh icon often appears, with an error number displayed below. The first non-zero digit is likely to be F. See System Software Problems, below.*

Extension software begins to load. Many extensions display an icon at the lower edge of the screen as they load. GemStart should be one of the first to appear (see Tech Tips 01, 03 for details about load order)

Exception:	*If the Welcome to Macintosh dialog begins to rapidly flicker or flash, and no further actions take place, the disk driver is corrupted, the disk driver is inadequately designed to run with an accelerator or with VIRTUAL, the disk driver is incorrectly configured, the System software is corrupted, there is an incorrect wait state setting, there are faulty SIMMs, or the drive is formatted at 1:3 interleave, rather than 1:1 interleave. If you have a 20MHz accelerator card, and DIP switch 4 is turned ON, GemStart tried to run the accelerator at 40MHz — reset DIP switch 4 to the OFF position. See Memory Problems, SCSI Problems, System Software Problems, below.*

GemStart displays a 'hotted-up Mac on wheels' icon or animation.

Exception:	*If GemStart cannot run because the accelerator cannot be accessed, a "crossed-out" icon, with a circle and slash superimposed, replaces the regular icon. On Macintosh Plus installations, this generally means the internal auxiliary power supply is not correctly connected—either the analog board or to the accelerator's 5V input. See Power Problems, below.*
Exception:	*If GemStart displays a "crossed-out" icon, with a circle and slash superimposed, it may be that the version of System software installed on the startup drive is earlier than the required version. GemStart 2.2 requires System 6.0.7 or later; starting from a drive with System 6.0.5 or earlier will lead to this symptom. See System Software Problems, below.*

Exception:	*If GemStart does not appear, and the Macintosh freezes up, it generally means the accelerator's CPU is having trouble communicating reliably with its SIMMs. This is generally caused by a short between the SIMMs and the chassis, incorrect wait state settings, improperly inserted SIMMs (not fully inserted into the sockets), or by faulty SIMMs. See **Memory Problems,** below.*

Galileo beeps, the external display displays the desktop pattern, and a large-screen logo is displayed in the center of the screen on which the menubar will appear. If the external display will contain the menubar, any further icons drawn by subsequent extension software are displayed on the large screen.

Exception:	*If the Galileo Control Panel cannot communicate with the video card, no dialog is displayed, and the beep is an abbreviated "half-beep". See **External Display Problems,** below.*
Exception:	*If the external display remains black, check after step 10 (below), to see if you can move the mouse off the edges of the internal display area. See **External Display Problems,** below.*

The Finder opens, and the desktop is displayed.

Exception:	*If the machine freezes just before the desktop should appear, restart and rebuild the desktop by holding down the Option and Command keys before the Finder opens.*
Exception:	*If the Macintosh freezes up or crashes after the desktop has appeared, use a utility program to check your hard drive's data structure. Disk First Aid comes free with your System software, but Norton Utilities for Macintosh™ is a better bet. With this eliminated as a potential cause, see **Memory Problems, System Software Problems, SCSI Problems,** below.*
Exception:	*If the internal [built-in] display shows semi-random "garbage" near the cursor as you move the mouse, check main logic board SIMM contacts are clean. See **Memory Problems,** below.*

Choosing About the Finder [System 6] or About This Macintosh [System 7] from the Apple menu opens a window showing memory and system details.

Exception:	*If your Gemini Ultra contains 4MB SIMMs, but the total memory installed is only 4MB, you have omitted to install VIRTUAL. See Tech Tip 02 for details.*

With VIRTUAL installed, a RAM disk icon appears below the icon for your hard drive.

Exception:	*If no RAM Disk icon appears, you have omitted to install VIRTUAL, or you selected the wrong model of accelerator card when you installed VIRTUAL. See Tech Tip 02 for details.*

If you are using an external display, you can now drag windows off the internal display onto the large screen.

Exception:	*If the external display shows semi-random "garbage" near the cursor as you move the mouse, check internal cabling, especially the VIS cable and connections. See **External Display Problems, below**.*
Exception:	*If the external display remains black throughout start up, and you cannot move the mouse entirely off either side of your internal display, the Galileo Control Panel software was unable to initialize the video card. Shut down, wait 45 seconds, and turn the Macintosh back on. If the symptoms recur, recheck internal connections, especially the 64-pin ribbon cable from the adapter card to the P4 expansion port connector on the accelerator. See also **External Display Problems, below**.*
Exception:	*If the external display shows semi-random "garbage" near the cursor as you move the mouse, check internal cabling, especially the VIS cable and connections.*

Memory problems

Short circuits

Plus   Ensure proper contact between the Killy clip and the CPU, if used. Check for short circuits between chassis underside and upper edges of accelerator SIMMs. Use insulation tape liberally — refer to figure 4-14. Check for short circuits between underside of accelerator and upper edges of main logic board SIMMs, inserting a plain business card as insulator if in doubt.

SE   Check for short circuits between floppy drive screwheads on chassis underside and upper edges of accelerator SIMMs. Remove floppy drive screwheads — refer to figure 3-6.

Wait states

Recheck legends on SIMM faces. Make sure the SIMM brand used is not listed as suspect in other sections of this manual. (See **NOTE**, pages 2-7 and 7-1.) Recheck DIP switches 5 and 6 for correctness. DIP switches 3 and 4 must match the clock crystal speed with the speed of the CPU, FPU and other major components of the accelerator card.

Main logic board

If your internal display shows semi-random "garbage" behind the cursor as you move the mouse, also known as the "dropped bits" syndrome, check the speed and condition of main logic board RAM. Part of main logic board RAM is used to map the internal screen's display area. With faster CPUs, the memory may not be fast enough for your accelerator. Clean the contacts on your main logic board SIMMs. If you still have problems, swap out 150ns or 120ns SIMMs for faster memory, preferably 80ns.

Operating Speed

20MHz Make SURE DIP switch 4 is OFF. The 20MHz Gemini Ultra cards ship with a 40MHz clock crystal that works correctly **only** if DIP switch 4 is OFF, running the accelerator at **half crystal** speed.

Altered main logic board RAM configuration

If you have changed the size or number of SIMMs on the main logic board, you must adjust main logic board resistor or jumper settings, or you'll observe various symptoms when you turn the power on. These include a black screen and/or loud, unpleasant noises or whistling from the speaker.

Faulty SIMM(s)

Particularly likely if the Macintosh shows a temperature- or time-sensitivity: it runs for a short time from a cold start, then successively shorter times after each restart. This usually indicates a SIMM which can't sustain its rated speed; memory runs slower when hot.

Exchange the position of one of a pair of SIMMs. The "Sad Macintosh" error code may change slightly. If two good SIMMs are swapped, the code won't change. If bad SIMMs are returned to their original location, the code changes back to its initial value. Replace faulty SIMM, and complete installation.

> **NOTE** Some SIMMs may work on your main logic board, but not on your Gemini Ultra, because of the more demanding requirements of high-speed operation. "Fussy" SIMMs can sometimes be used on the main logic board, rather than discarding them out of hand.

System Software Problems

- Consult Tech Tips 00, 01 and 03 for detailed troubleshooting steps.

Power Problems (Macintosh Plus)

- Recheck auxiliary power supply *input* connections to the analog board. If these are attached incorrectly, the internal auxiliary power supply can't feed the accelerator with the 5v supply needed to run reliably.

- Recheck the auxiliary power supply *output* cable is attached to the accelerator. If correct, use a meter to confirm that the output cable is supplying 5v to the accelerator when the Macintosh is powered up. BE CAREFUL! DON'T TOUCH HIGH-VOLTAGE PARTS, ESPECIALLY ON THE ANALOG BOARD AND CRT!

- Especially after installing a Galileo video expansion system, readjust the analog board output such that the voltage at floppy port pin 6 measures a true 5V. Confirm that this reading is stable by measuring when the Macintosh cannot find a System to start up from (shows flashing question mark).

SCSI Problems

- Consult Tech Tips 00, 01 and 03 for detailed troubleshooting steps.

Cabling

Plus: Check the SCSI cable running from the Gemini Ultra card to the battery door high-speed SCSI connector; it may have come loose or have been omitted during installation. Make sure your external SCSI cable is plugged into the high-speed port — **not** the original SCSI port!

- Use the shortest cabling possible. Avoid devices with 25-pin SCSI connectors, as opposed to 50-pin SCSI connectors. With fewer ground leads, they are more prone to electrical

noise and signal degradation, especially as total cable length rises. Cables are *easily* damaged by bending through too tight a radius — they contain many fine, delicate conductors.

- Make sure all devices have a different SCSI ID number.

- Make sure you have no more than 2 terminators connected on your SCSI chain. On Macintosh Plus and earlier, the Gemini Ultra **includes 1 built-in terminator.** When used with the Macintosh SE, the Gemini Ultra does **not** change the SE's termination status. If you are unsure of the termination status of other SCSI devices, contact the manufacturer for information. Do **NOT** risk component damage by potentially over-terminating your SCSI chain — it can be extremely expensive! Wherever possible, use external terminators, rather than internal device termination — that way, you can check the termination status of your chain at a glance.

- Use a single disk driver with all connected hard drives. Some different drivers conflict; a single driver saves (a little) memory.

- Try connecting only one external SCSI device at a time, and establish communications that way. Use a logical approach to narrow down the culprit to a single device or cable.

Driver Software

- Low-cost, generic drives usually include low-cost, generic driver software. The hardware is usually **much** better than the software. Penny-wise performance-conscious consumers buy great mechanisms at generic prices, and add high-end driver software for maximum reliability and performance!

- Try driver configurations **without** blind transfers first. Once your system is working reliably, experiment with blind transfers if you feel bold.

Drive Mechanism Speed

If you cannot start the Macintosh from your hard drive, and **if** you are using one of the disk driver packages recommended in the Tech Tips included on your GemStart disk, the problem **may** be that your hard drive does not run fast enough for your Gemini Ultra. In ordinary use, this is not a problem, but the timing of the interactions between the Macintosh and the disk it is starting up from is **critical**, and a mismatch will cause problems.

- Start from a floppy disk containing system software and GemStart. With a multi-drive system, a mounter extension such as SCSI Probe should bring drives onto the desktop.

If your Macintosh starts, and the hard drive icon shows up on your desktop, then your hard drive may be one of a small number which do not respond fast enough during start up, although it will work satisfactorily otherwise. You can resolve this problem in several possible ways:

☐ 1. Contact the manufacturer of your hard drive or third-party driver package, to **ensure** you have the latest disk driver version. Retest after installing the updated driver, and see if this solves the problem. Typically, you **won't** have to reformat the drive to do this.

☐ 2. Experiment with the startup speed using DIP switch 3.

☐ 3. If the interleave on your hard drive is currently at 1:2 or 1:3 interleave, change it to 1:1 interleave. (Rarely —if it is currently at 1:1 interleave, change it to 1:2 or 1:3.) You **will have to reformat your hard drive** to do this. Retest to see if this solves the problem.

☐ 4. **Try another disk driver package.** Refer to Tech Tip 00 for recommendations, check the READ ME document on your GemStart disk for up-to-date advice, or call TOTAL SYSTEMS for up-to-the-minute driver recommendations.

☐ 5. If you have a multi-drive system, use another drive as a start up device.

☐ 6. Try a new, faster hard drive. Though a new drive is an expensive solution, it will also prevent your accelerated Macintosh being strangled by slow drive throughput.

External Display Problems

Display

- Make sure the external display is **powered on**, and its power light is on; check all external cabling is properly connected; turn **Brightness and Contrast** controls to maximum to make sure that the screen display will be visible during troubleshooting—adjust for optimal viewing after you have got things working.

Galileo Configuration

- Unless the Galileo Control Panel is installed, your external display won't work!!

- Difficulties with the external screen are easiest to deal with if you keep the menubar set to the internal screen until everything is working correctly.

- To disable the external display during start up, hold down the M key.

VIRTUAL Configuration

- If the external display remains completely black after start up, check the VIRTUAL Control Panel Monitor Settings are correct. Refer to Tech Tip 02 for more details.

- To disable VIRTUAL during start up, hold down the ~ (tilde) key immediately after power up, until the VIRTUAL icon appears.

Cabling

Plus: Check the VIS cable running from the main logic board to the adapter card; it may have come loose or have been omitted during installation. If this cable is omitted, or if all the appropriate connections are not made using the various VIS clips, the external display may show the "dropped bits" syndrome: random "garbage" appears near the mouse cursor.

SE: Check the red cable running from the main logic board to the adapter card; it may have come loose or have been omitted during installation. If this cable is omitted, or if all the appropriate connections are not made using the various VIS clips, the external display may show the "dropped bits" syndrome: random "garbage" appears near the mouse cursor.

All: Check the 64-pin ribbon cable running from the main logic board to the adapter card; it is quite hard to seat completely during installation. If it isn't properly seated, symptoms vary: the Galileo Control Panel simply won't "see" the video card correctly, or the entire Macintosh may not even start up properly.

Short Circuits

Plus: Vertical black and white bars at start up may indicate a short circuit at the adapter card. Check that the two small rubber washers have not been omitted when attaching the adapter card to the GemFan bracket.

SE: Check the rubber foot on the underside of the video card is correctly positioned. Short circuits between the card's components and the CRT housing, disk drive housing, or disk drive circuitry can cause a variety of symptoms.

Post-Installation Problems

Crashing erratically

If your Macintosh crashes at unpredictable intervals, after your accelerator has been installed and running for a reasonably extended period, refer to Tech Tips to:

- Check newly-added extension software for conflicts

- Reinstall System software.

- Reinstall your disk driver software.

You are extremely likely to find that your problems cease; if not, call TOTAL SYSTEMS Technical Support for assistance.

Crashing repeatably with specific application software

If you experience repeatable crashes while using a specific application, the application may be corrupted — or you may have encountered an actual software incompatibility. **Genuine incompatibility problems are very, very rare.**

☐ 1. Consult **Using the Gemini Ultra**, above, and the Tech Tips on your GemStart disk, for optimal installation procedures which **successfully resolve the vast majority of suspected software incompatibilities.**

☐ 2. Reinstall the application. Make sure you replace *all* support files, especially the Preferences file(s), which often lurk in the System Folder (Preferences folder under System 7). **A corrupted Preferences file** will do it to you *every* time.

☐ 3. Contact TOTAL SYSTEMS Technical Support for more information.

Gemini Ultra
upgrade procedures

Upgrading RAM

Remember that all four SIMM holders on the Gemini Ultra must contain the same size SIMM, where size refers to 1 MB or 4 MB of RAM.

> **NOTE** The brand of 1 MB RAM chip known consistently to fail with the Gemini Ultra is manufactured under the name "NMB" or "NMBS". Siemens and Hyundai are sometimes unsuitable. Check with your supplier to ensure that SIMMs with these chips are not used.

The procedure for upgrading RAM from 4 MB to 16 MB, to replace existing RAM with a faster kind, or to move RAM from the main logic board up to the accelerator is the same.

☐ 1. Unclip each SIMM from its SIMM holder by gently prying open the plastic clips which hold it in place at the ends of the SIMM. Use your thumbnails to pry the clips apart, while using your forefingers to pull the SIMM forward.

> **NOTE** Be careful not to pry the plastic clips open too far or too hard – they are made of quite brittle plastic, and will break easily.

☐ 2. Carefully pull the SIMM module forward along its top edge, so that it rotates from its original forty-five degree angle to a more vertical position, and release the plastic clips when the edges are clear.

☐ 3. You may now lift the SIMM out of the holder in which it is seated.

Install the new SIMM into place by reversing this procedure. Be sure to seat the SIMM properly into its holder before clipping it into position. Repeat the process until all four SIMM holders are occupied.

Moving the Gemini Ultra from a Macintosh SE to another computer

The standard Gemini Ultra is installed on the Macintosh SE using the standard SE slot connector.

A TOTAL SYSTEMS retrofit kit is required to install a Gemini Ultra in a Macintosh Plus. The retrofit kit consists of:

- Killy clip, allowing quick snap-on connection to the main logic board.

    -OR-

- Solder-pin modification kit, which allows a stable electrical and mechanical connection to the main logic board for maximum long-term reliability.

    -AND-

- GemFan 110v internally-mounted cooling fan with integral aluminum mounting bracket.

- GemPower auxiliary power supply module.

- High-speed SCSI interface cable assembly.

- U20 PAL

Moving the Gemini Ultra to a Macintosh SE from another computer

If you wish to transfer your Gemini Ultra to a Macintosh SE, you will need to remove the components of the retrofit kit above, before completing your new installation.

Increasing the speed of the Gemini Ultra

While the Gemini Ultra can be upgraded to run at any of the supported speeds, some higher speeds may require new components which are soldered in place. Since reliable replacement of these components is essential, an exchange of accelerator cards is necessary to upgrade their performance rating. To upgrade from 20 MHz to 50 MHz, for example, requires a swap of the 20 MHz Gemini Ultra card for a 50 MHz card, so that the soldered components are changed. In all cases, components such as the 68030 CPU, optional 68882 FPU, clock crystal and SIMMs must individually be capable of operating at the higher speed. These components, though, are socketed, and can be upgraded in the field.

The following steps describe the procedure for replacing the socketed components.

You will need a special tool called a "PGA Tool" to reliably remove the existing CPU or FPU chips on the Gemini Ultra. If you do not have access to a PGA Tool, call TOTAL SYSTEMS before proceeding any further with a CPU or FPU upgrade.

Warning!

Regardless of the CPU or FPU component in question it will be very firmly anchored into its socket. Removal of an existing component is not easy and damage to the chip itself or your Gemini Ultra can easily result. **TOTAL SYSTEMS** *is not liable for any damage caused by the removal of a CPU or FPU from the Gemini Ultra.*

If you have a PGA Tool, proceed as follows:

☐ 1.   Use the PGA Tool to remove the CPU or FPU.

☐ 2.   Refer to the appropriate **Installation** section for your machine and follow the instructions outlined there for installing the replacement component(s) in question.

The legs on the clock crystals supplied by TOTAL SYSTEMS are pre-cut to the proper length. If you are providing your own clock crystal, be sure to trim the legs to .2".

Use the following instructions to install a new clock crystal:

☐ 1.   Note the orientation of existing crystal, before removing it from the Gemini Ultra.

☐ 2.   Gently pry the existing crystal loose from its sockets, using a medium flat-blade screwdriver.

☐ 3.   Press the new crystal into place. Refer to **Preparing the Gemini Ultra, Chapter 2.**

Glossary

accelerator card: An expansion card that contains another processor that shares or takes over the work normally performed only by the computer's main microprocessor. An accelerator card reduces processing time.

analog board: The board that contains most of the analog functions of the Macintosh, including a power supply, video and sweep circuitry.

application program: A program that performs a specific task, such as word processing, database management, or graphics. Also called an application.

battery door: The removable cover on the back panel of the Macintosh Plus and Macintosh 512K computers, which gives access to the replaceable battery. The battery preserves the clock settings and parameter RAM contents when the power is off. Control Panel settings are kept in battery RAM.

caching (pronounced "cashing"): A technique for storing information for rapid re-use at a later time. See **data cache, instruction cache.**

central processing unit (CPU): The "brain" of the computer; the microprocessor that performs the actual computations in machine language. In a Macintosh, it is referred to as 68000, 68020, 68030, or microprocessor.

chassis: The metal structure which serves as a frame for the Macintosh, and provides an electrical ground for the components attached to it.

coprocessor: An auxiliary processor that is designed to relieve the demand on the main processor by performing a few specific tasks. Generally, coprocessors handle tasks that could be performed by the main processor running appropriate software but which would be performed much more slowly that way.

CRT driver card: A small, square printed circuit board attached to the rear end of the CRT. Provides signals which controls an electron beam, displaying data on the CRT.

data bus: The path along which general information is transmitted within the computer. The wider the data bus, the more information can be transmitted at once. The Macintosh II, for example, has a 32-bit data bus, as does the Gemini Ultra card. Thus, 32 bits of information can be transferred at a time, so that information is transferred twice as fast as in 16-bit computers (assuming equal system clock rates).

data cache: Newer processors, such as the 68030 CPUs, use a *caching* technique to store recently used data in very fast RAM inside the processor. If the data is needed again later, it can be accessed immediately, without having to reload the information. See also **instruction cache.**

DIP switch: A set of switches packaged in a narrow rectangular box. On the Gemini Ultra, a bank of DIP switches control wait state settings and other configuration details.

expansion connector: A connector inside the Macintosh SE that lets you install an expansion card to enhance the computer's performance.

expansion slot: A narrow socket into which you can install a peripheral card. Sometimes called a *peripheral slot* or just *slot*.

Floating-Point Unit (FPU): See **floating-point coprocessor.**

floating-point coprocessor (MC68881, MC68882): A coprocessor available for the Gemini Ultra card that provides high-speed support for extended-precision arithmetic.

guide rails: The lower parts of the *chassis* of the Macintosh, which serve to locate the main logic board. Shaped with special grooves, these grip the main logic board by its edges on either side, and normally allow it to be removed by sliding it out towards the rear of the Macintosh, once all the cables have been disconnected. After the Gemini Ultra card has been added, the main logic board cannot be replaced or removed in this way, and the rails must instead be carefully levered outward to one side to release an edge of the main logic board.

instruction cache: A fast storage facility for recently-used processor commands. The 68030 CPU uses a *caching* technique to store recently executed instructions in very fast RAM inside the processor. If the instruction is needed again later, it can be accessed immediately, without having to reload the information. See also **data cache.**

Killy clip: A heavy-duty plastic clip that locks down on a 68000 CPU which is used to attach the Gemini Ultra card to the main logic board.

main logic board: A large circuit board that holds RAM, ROM, the microprocessor, custom-integrated circuits, and other components that make the computer a computer.

processor: The hardware component of a computer that performs the actual computation by directly executing instructions represented in machine language and stored in main memory. See also **microprocessor.**

programmer's switch: The plastic accessory switch shipped with the Macintosh. Used to disable the Gemini Ultra card on start up. The programmer's switch is described in Appendix C of the Macintosh Plus Owner's Manual. Install the programmer's switch by snapping it into place on the left side of the Macintosh, toward the back, in the second slot from bottom. See also **reset button.**

QuickDraw: The part of the Toolbox that performs all graphic operations on the Macintosh screen.

RAM cache: Random-access memory you can designate to store certain information an application uses repeatedly. Using the RAM cache can greatly speed up your work, but may

need to be used sparingly or not at all with applications that require large amounts of memory. You set the RAM cache in the Control Panel after choosing the General icon.

RAM disk: A portion of RAM that appears to the operating system to be a disk volume. Files in a RAM disk can be accessed much faster than the same files on a disk.

reset button: The front part of the programmer's switch, when installed on the Macintosh. Used to restart the Macintosh immediately. Using this switch carelessly can cause loss of data. See also **programmer's switch.**

SCSI: An acronym for *Small Computer System Interface* (pronounced "SKUH-zee"). An industry standard interface that provides high-speed access to peripheral devices.

SCSI terminator: A plug that absorbs the signals traveling along a SCSI cable, keeping the path open for new signals. One terminator is built into the Gemini Ultra when used with the Macintosh Plus. The accelerator does not change the terminator status of the Macintosh SE. Use only one external terminator. Do not use more than two cable terminators.

SCSI devices: Devices, such as hard disks and tape backup units, that use the Small Computer System Interface.

SCSI port: The port on the back panel of the computer to which you connect SCSI devices.

SIMM: An acronym for *Single In-line Memory Module;* a circuit board that contains eight RAM chips. SIMMs attach to SIMM sockets on the computer's main circuit board. SIMMs are also available with nine RAM chips; the ninth chip is used for parity checking on other computers. The Macintosh does not presently support parity checked memory, and ignores the ninth chip. See also **parity, parity bit, parity error.**

68000: The microprocessor used in the 512K Macintosh, Macintosh Plus, and Macintosh SE.

68030: The microprocessor in the Macintosh SE/30 and Macintosh IIx. The Motorola 68030 can also be added to the Macintosh SE by means of a Gemini Ultra card installed in the SE Buss expansion connector. The 68030 contains both an *instruction cache* and a *data cache,* and is significantly faster than the 68000. The 68030 also contains the equivalent of a built-in 68851 PMMU.

68851: An optional coprocessor available for the Macintosh II that allows paged memory management, a technique that lets the microprocessor access a much larger body of data than can fit in RAM at one time. Sometimes referred to as the *Paged Memory Management Unit,* or *PMMU.*

68882: A coprocessor that provides high-speed support for processing scientific computations. Sometimes referred to as the *floating-point unit,* or *FPU.* The 68882 is significantly faster than the 68881, and is recommended for use on a Gemini Ultra card fitted with a 68030 CPU.

Standard Apple Numerics Environment (SANE): The set of methods that provides the basis for floating-point calculations in Apple computers. SANE meets all requirements for ex-

tended-precision, floating-point arithmetic as prescribed by IEEE Standard 754 and ensures that all floating-point operations are performed consistently and return the most accurate results possible. SANE methods are usually executed in software; one of the options with the GemStart utility software allows you to force SANE to be executed by the FPU on your Gemini Ultra card, if installed. This dramatically speeds up SANE operations.

start up: To get the system running. Starting up is the process of first reading an operating-system program from the disk and then running an application program. Synonymous with **boot.**

startup disk: A disk with all the necessary system files—such as the Finder and other system software contained in the System Folder for the Macintosh—to set the computer into operation.

System file: A file all Macintosh computers use to start up and to provide systemwide information.

system software: The component of a computer system that supports application programs by managing system resources such as memory and I/O devices.

throughput: Used to describe the process of computation or other work performed on data. Usually describes relative rates of working.

User Interface Toolbox: The software in the Macintosh ROM that helps implement the standard Macintosh user interface in an application. One of the options with the GemStart utility software allows you to force the ROM Toolbox to be copied into RAM on the Gemini Ultra card. This can significantly speed up Toolbox operations, particularly in graphically intensive applications that use QuickDraw heavily, since the RAM on the Gemini Ultra card is usually faster than the Macintosh ROM.

virtual memory: Memory space that is separate from the main memory (physical RAM) and is instead located in auxiliary memory media (usually disks). The ability of a system to address virtual memory space is important for multitasking operating systems and applications too large to be handled in RAM alone. Virtual memory requires a *PMMU*. See also **68030.**

wait states: One or more idle processor cycles after a memory access, during which the processor waits for the data it has requested to be made available to it. This allows a processor to function correctly if it operates faster than the memory it is connected to. Processor cycles during a wait state are wasted; consequently *throughput* is reduced in a system with wait states.

write-protect tab: The small plastic tab in the corner of a 3.5-inch disk jacket. Lock (write-protect) the disk by sliding the tab toward the edge of the disk; unlock the disk by sliding the tab back so that it covers the rectangular hole.